

DRAGON USER

International edition

The independent Dragon magazine

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January 1984

Hints to give
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the edge

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for Dragon

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How to submit articles

The quality of the material we can publish in
Dragon User each month will, to a very great
extent, depend on the quality of the dis-
coveries that you can make with your
Dragon. The Dragon 32 computer was launched
on to the market with a powerful version of
Basic, but with very poor documentation.

Every one of us who uses a Dragon will be
able to discover new tricks and tricks almost
every day. To help other Dragon users keep
up with the speed of the development of
all its most valuable that we made the
discovery first — that others writing it down
and putting it on to others.

Articles which are submitted to Dragon
User for publication should not be more than
3000 words long. All submissions should be
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double space between each line. Programs
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printed on plain white paper and be accom-
panied by a tape of the program.

We cannot guarantee to return every
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addressed envelope.

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Editorial

THE SAGA of the official Dragon 32 upgrade is continuing, with Dragon Data being
dogged by statements it has made in the past.

Predictions on the cost and timing of the upgrade varied considerably during the
course of last year. First, an expansion kit giving 64K of RAM was proposed for the
middle of May. Then the add-on was expected to cost about £30. By June this had
become a board-wrap at a cost of £75. A month later plans had changed to a CPU swap
scheduled for September at an expected cost of about £180. This swap was to give
Dragon 32 users 64K of RAM, two ROMs and an RS232C interface. At the time Tony
Ciecha, Dragon Data's former managing director, explained that software compatibility
was behind the second thoughts — the proposed CPU swap would enable Dragon 32
software to run on the Dragon 64.

However, come autumn, with Brian Moore newly installed as managing director, and
the plans had become less specific. Now it seems possible that the company is having
further second thoughts — preferring to exchange Dragon 32s for 64s rather than
upgrade them. The logistics of a part-exchange would certainly be simpler than
swapping CPUs which would originally have involved service agents. Less certain is the
reaction of Dragon users to the cost of such a proposal — write to tell us what you think
and we'll make sure your views are known.

Part-exchange would be a new idea in this country, although Commodore used it in the
US, reducing the price of its 64 to Vic20 owners returning their machines. Commodore,
however, has not been so generous about software compatibility. The American
company has been content to open the market for its two home computers, so that Vic20
users moving up to a CBM-64 have been left with redundant software. Commodore does
not seem to have suffered too much from this anti-operative attitude and some people
argue that Dragon Data should have taken a leaf from the American company's book.
The suggestions, from businessmen in the micro industry rather than from hobby users, is
that Dragon Data's intentions may be too favourable for its own good — again, let us
know what you think.

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Letters

This is the chance to air your views — send your tips, compliments and complaints to Letters Page, Dragon User, 12-13 Little Newport Street, London WC2R 2LQ.

Calling all clubs

I WOULD like to know if there are any microcomputer clubs in the North Lancashire area for beginners. So far I have not been able to find any after two months of searching.

J Hogg,
Loughborough,
Leics.

Dragondos criticised

WE THINK we have found two bugs in the Dragon 32 disk operating system.

The first is related with the CHAIN command. This command allows the user to load and run a second program using the same data as the first program. The bug is, in sometimes pushes the program into the Disc's buffer, creating the program. Possibly, this can be avoided by executing a FREE command in conjunction with the CHAIN command.

The second is a lot more serious and concerns the RUN command. The syntax for the RUN command is RUN "DRIVE" : RUN NAME, BAS" for a Basic file or .BIN for a machine code program. The use of a disk system can be made easy with a disk maintenance program. The user only uses the "key" command and types the program's name; the rest is under software control. For example, INPUT PS (FILE NAME) LOAD PS = " : BAS"

This will LOAD the program PS. The bug is that the RUN command cannot accept a \$FILENAME. All other commands seem to be OK.

H Franco and D Barnett,
Cardiff

... and defended

I READ the recent article by Keith and Steven Isaac, comparing the Dragon 32s and Phoenix disk systems, with interest (and, by the end of the article, some annoyance).

I've used the DS unit regularly since I bought it in mid-December and find it very useful for program development — there my standpoint several of the features the Brains' user-poster very useful. The automatic res-

tion of a backup file removes the possibility of a too-frequent disaster — creating a new file sometimes with nothing in it) with the same name as a wanted older version.

Equally important, it's necessary to find the dictionary is duplicated on tracks 16 and 26. Several of the toolbar commands (especially AUTO) are also surprisingly useful, and make for a more user-friendly system (a characteristic the Brains rightly hold dear). Everyone is entitled to his own view on the value of these commands (and I'm clearly quite happy with them). However, when it comes to the question of file structure, I find myself at variance with your reviewers' own masters of fact.

On the Brains' own definitions, the two principal file-types are "random-access", in which "each record can be read from or written to independently" and "serial files" in which "to recover a particular item you must start from the beginning and work your way through all the items in sequence until you find what you are looking for", and in which "adding data to, or deleting data from the memory necessitates re-writing the whole file". They claim that the "file-handling capabilities of Dragondos are relatively simple, and effectively restricted to the serial type" and that the example given in the Dragondos manual entitled "simulated random-access" "really describes a rather inefficient serial file with lots of blank spaces in it".

This would, indeed, be an important criticism, if true. Since reading these comments, I've spent some time playing around with these "simulated" random-access routines and looking at the results on disk using SEARCH (a function the Brains' just quietly own).

It appears that the technique in the manual does indeed replace

new data in a record in the bytes vacated by the old record, without rewriting the whole file (there are no "holes", except those that pad out the fixed-length records) and that it accesses all records on an equal and rapid basis (the complex structure of the Dragondos dictionary would be a waste of time if it were otherwise). However, that this is a random-access, rather than a serial technique doesn't really require deep study — it's evident just in using it a few times.

J Hall,
Surrey

A pause alternative

IT IS often necessary to pause a program by either using the FOR-LOOP method such as:
FOR I = 1 TO 500 NEXT I
or
TIMER = 0.5 timer = 500
END

But these methods can be both time and memory consuming. A much better method, especially if you only want a relatively short delay in the program, is to use the Dragon's Play command by typing PLAY "P" — which gives a delay of about 2 1/2 seconds or PLAY "PS" for a shorter pause.

K F Kent,
Manchester

Harder Pontoon

WE HAVE enjoyed playing with the Pontoon game submitted by I Saunders (Open File, September 1983) but thought that readers might be interested in this slightly more realistic (and harder) version.

The following features have been added to the old version:

as 1 or 11 (most of the calculation for this was in the original); the computer is allowed to bust, or make 20, and decides whether to do so at a bit at random; a five-card trick is rewarded with a bust.

On the technical side, the FORs have been removed since they are not necessary in this type of game; you can speed things up by shortening the wait loops if you wish. Defined functions have been used to calculate the card values and check for aces.

The changes to the original version are as follows:

```
65 DEF PNA(X) = INT(X - 11/10)
67 DEF PNB(X) = PNA(X) - (X - 11/10)
100 FOR X = 1 TO 5:GOSUB 1000:GOTO 2: NEXT X
300 P=X = "P" THEN 300
510 IF X = "C" THEN 500
330 REM Check for Aces
350 IF PT = 21 AND PNB(X) THEN PT = PT - 10: P=X = 0
360 IF PT > 21 THEN CLS
4 POINT = 0:20: "DRAWN!"
YOU'RE BUST!" CH = CH + 1: SOUND 50,5:GOTO 400
380 IF CT < 16 + PNB(X) THEN X = 22: C=0:GOTO 500:CT = CT + 1
390 FOR X = 1 TO 3: IF CT > 21 AND PNB(X) THEN CT = CT - 10: C=X = 0
397 NEXT X
407 IF CT > 21 THEN CLS
4 POINT = 0:20: "DRAWN!"
YOU'RE BUST!" CH = CH + 1: SOUND 50,5:GOTO 400
Line 410, 420, 430, 440 are all as compiled in a similar way.
420 IF X = 0 THEN CLS
5 POINT = 0:20: "DRAWN!"
CARD TRICK?" FOR A = 1 TO 5:PLAY "12345678910"
A:GOTO 450
450 GOSUB 0.1 FOR A = 1 TO 100: NEXT A:GOTO 500
500 FOR A = 1 TO 100: NEXT A:GOTO 80
Go 100-540 since we are likely to want many more games.
510 REM PNA
4010 S = PNA(X) + 1
4040 IF S > 10 AND S < 14 THEN T = 10 ELSE T = 5
5055 GOSUB 0.1
We find that it is much harder to beat the computer at this game, and spend many tries to get the elusive five-card!

```

F and J Harris,
Sunderland

Software Top 10

1	(4) Frogger	Microcad
2	(7) Mixed Up!	Clackdavis
3	(3) Cuthbert in the Jungle	Microcad
4	(1) The King	Microcad
5	(10) Ring of Darkness	Winterson
6	(2) Champion	Peaksoft
7	(6) Pettigrew's Diary	Shands
8	(5) George Data Tank	Caldersoft
9	(8) Dragonfly 2	Hewson Consultants
10	(3) Engines	Shands

Chart compiled by Boots



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Part-exchange path preferred

DRAGON DATA has decided to part-exchange (30s for 30s rather than upgrade them.

The unquoted cost of the exchange to a 32 user is £140, saving £85 off the cost of a Dragon 64 — possibly less than can be raised by selling your 32 second-hand.

This price, and the policy itself, mark a change from the

company's original intentions.

Earlier in 1983 Dragon Data was proposing to offer an upgrade service, at a price which eventually rose to about £100.

Some users are likely to object both to this change of policy and to the cost involved.

Adopting part-exchange not only breaks with Dragon Data's previous statements

but also with tradition.

Only Commodore has pursued such a policy, and that only in the US where it dropped the price of its CBM 64 for 1600 owners returning their machines.

Full details of the part-exchange are contained in the December issue of Dragon Data's newsletter *Stop Press*.

New home for Ninja Warrior

A NEW over US distribution of cassettes from American software house Programmers' Guild has been settled.

The cassettes, among the best-sellers in the US and including such titles as *Ninja Warrior* and *Pacemate*, are now being distributed by Program Factory, 39 Railway Road, Garston, Lancashire.

Program Factory is also handling previously unfilled orders sent to Programmers' Guild UK — and will be handling any new US titles which cross the Atlantic.

Monster challenge

A PRIZE of £10,000 could be yours if you solve two games from Tving Systems Software and then win its *Countdown Quiz*.

The suite of six games, developed in association with the lottery Clive Lee Travis, are designed to test your intelligence, powers of reason and keyboard dexterity.

Dave promises: "These games will have people beating their heads on the floor with frustration."

But if you can solve the first

five you may be eligible for the *Countdown Quiz*, whose winner will receive £10,000.

At the moment the games run on the BBC and Sinclair micros as well as the Dragon. Each costs £8.50.

Dave added: "We know the games are difficult — we just don't know how difficult. We've don't know how long it will take us to get the 10 finalists together."

Tving Systems Software can be reached at 8 High Street, Wincoburn, Bucks.



Dave Lee Travis — "We know the games are difficult"

Dragon Data software push

DRAGON DATA is stepping up its attack on the software market, issuing new titles for the 32, bundling games for disk users and marketing professional packages for the OS-9 operating system.

The range of new games for the 32 includes arcade titles, adventures and simulations — alone and in combinations.

For example, *Lunar River Patrol* is an arcade-type game using "expert graphics" to simulate the moon's surface, while another tape combines two games: the arcade *Break-out* and the adventure *Middle Kingdom*.

Other adventures include *Viking*, *Monsters* and *Magic* and a trilogy from US software house Colorsworld. Simulation fans have *Tes-a-hi* and *Flight* to look forward to.

Dragon Data has also licensed *Bridge Master* from Intelligent Software, the pac-

kie behind the already available *Chess*.

Of particular interest to readers of *Dragon User* will be the arrival of *Junior's Revenge*, whose author was interviewed in our October issue. This is a Dragon version of the arcade classic *Donkey Kong Jr*, as Microsoft's *The King is of Donkey Kong*.

All these games will be appearing in new packaging of video cassette-tape cases — as will the previously announced new releases.

Dragon Data also has plans for disk drive users. The company wants to make sure that "people who buy drives don't feel left out," explained technical software manager Duncan Smead.

Cassettes and cartridge titles are being bundled together on disk in threes, fours and fives

— to give, for example, an adventure disk.

The modular operating system OS-9 will now be available in January at a price of around £30.00. The software is ready, but the manuals still have to be finished.

Duncan thinks that OS-9 is Dragon's "passport" to the small business/home user market — particularly in the light of the system and application software that will also be available early next year.

System software includes *Pascal* and *Basic 65*, a structured version of *Basic* which is itself similar to *Pascal*. In fact Duncan says "it's got so many extra features you can't really call it *Basic* any more".

A C compiler will give the system "a high degree of portability" so that "any program that runs under Unix can run under OS-9".

These languages can also be used together under OS-8, with each module being written in the source language most suited to the task.

Applications software includes a word processing package called *Syllograph* at £50.00, *Dynacalc* for spreadsheet analysis, and *DBMS* for database management, both at £50.00.

Syllograph, which benefits from the 51 by 84 line screen on OS-9, also offers a spell checker and mailmerge facility.

Duncan stressed that this "inexpensive" pricing is no reflection on the packages' quality. "These are very professional products which we can offer at these prices only because of our high volume purchasing and licensing agreements," he explained.

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Peaksoft sends its thanks, and the season's greetings, to the many new friends and customers made in 1983.

We send special thanks to all who have taken the trouble to write to us, and express our admiration for such individuals as:

Richard Dille, who played Champions! non-stop for 37½ hours to win the European Cup.

David Symes, who tells us he managed it in 54 minutes. (We think that's the record.)

Red, Terry, Mike and the two Dicks, who raised almost £50 for their youth club with a 24-hour "Champ-a-thon".

Sam Spawey, who resisted the temptation to leave Terry Wogan and Koo Stark in Death's Head Hole, and achieved (we think) a record score of 1,460.

Peter Slack, who rescued the 9th screen of SAS (even we haven't done that without cheating!) before being cornered by a helicopter.

We look forward to renewing old friendships, and making many more, in 1984.

Talking to your Dragon

LOW COST speech recognition next spring is the promise of Brighton-based Orion Data.

Called Micro Command, Orion's speech module translates commands spoken via a microphone into signals which your Dragon will understand.

The module, with microphone attached, slots into the Dragon's edge connector socket.

A Teach program loaded from cassette allows you to train the Dragon to recognise up to 15 words you speak into

the microphone. A Listen program then checks that the words are being recognised correctly.

An instruction leaflet explains how to incorporate the spoken commands into your own programs or use them to replace keyboard or joystick control in other games.

The cassette also contains Sheshtalk, a game which already uses speech commands.

Micro Command already runs on the Spectrum at £49.95 and Orion expects to have a Dragon version available at the same price next spring.

Included in the price are the speech recognition module, microphone, cassette and instruction leaflet.

Orion Data's address is 3 Cavendish St, Brighton, Sussex.

Windrush bring in Bug-Zapper



Inside Windrush More Systems' Bug-Zapper EPROM programmer

The latest programming tool from Windrush More Systems is Bug-Zapper, an EPROM programmer which takes its place alongside the Mace assembler and D-Bug disassembler.

Bug-Zapper plugs straight into the Dragon's cartridge port and needs no extra power supplies or batteries. It is a development of Windrush's professional EPROM programmer which is already in use on C64s and Plus, the two most popular systems for 8080-based micros.

The cartridge includes an 8K ROM with all the software necessary to operate the programmer. The choices on the menus provide a range of facilities.

For example, you can FILL the programmer buffer with specified hex characters, MOVE data within the buffer, EXAMINE/CHANGE the contents, and then DUMP them to the screen or printer.

Bug-Zapper costs £79.95 complete with documentation. For an extra £15 you can buy the EPROM programmer and Mace on the same cartridge.

Mace is Windrush's editor/assembler/monitor which sells at £29.95. It also comes in a combined cartridge with D-Bug for an extra £20.

D-Bug, a trace/monitor/disassembler package, costs the same as Mace on its own. Owners of either cartridge are being offered a £15 trade-in allowance.

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Desert Island Dragon delights

John Scriven picks his favourites from the past year's offering of software - revisiting arcade hits, crib tables, strange lands and programmers' benches

AT THIS TIME of the year, there may well be more family disputes than usual over TV sets. With parents and kids all at home at the same time, even the family with two sets could find problems in sharing these out fairly. The delights of James Bond, Top of the Pops and The Incredible World of Disney have to be carefully weighed against alien destruction, mass explosion and the latest database program. If someone is also hiring videos then you would indeed be lucky to get through unscathed.

My advice would be to buy copies of Radio and TV Times as soon as possible and draw up a timetable of TV sets if you want to avoid the divorce courts in the New Year. Just think, only five years ago there were hardly any mums in the home, few videos, and only three channels to argue over; such is the pace of progress...

For those of you with any money left (at some sanity), after the Christmas madness, I have been casting my eyes over the year's software in an attempt to suggest best buys. In the past I used to grade programs on a 1 to 10 scale for size of graphics, speed, novelty, sound, etc, and end up with a tedious table of results. This came to be more and more difficult as I realised that so much depended on personal taste and I have avoided this approach recently. However, the editor came to me on his knees muttering something about "desert island cassette" and "which ones would you like to be marooned with?" As there was a threatening look in his eye I decided to comply. So now I found myself shipwrecked with eight copies of invaders and my Dragon for company.

I have tried to spread the net as wide as possible to include a variety of programs, but undoubtedly there will be some good ones that escape.

My favourite arcade games tend to be those that avoid aliens rather than pursue them, and those that show originality as well as fast action are more likely to get my vote.

On the mat

Ninja Warrior, from Programmers' Quest is an obvious choice here. Starting out as a martial arts training program, it increases in difficulty to make TFI's Kung Fu look like Play School. In this excellent game, you, and up to five other players, control a small

figure dressed in a judo suit. The ground tremors beneath his feet, and you can use the joystick to slow him down, speed him up, or make him jump in the air. The 'first'

button controls his sharp karate kick.

To gain a white belt, the landscape is filled with obstacles that he can jump over, but a higher score is achieved by kicking them to dust. If he survives this without breaking his legs, the tests for higher grade belts present him with trees to jump over, pits to traverse and even arrows to catch. Eventually your warrior becomes a black belt. I find this a highly entertaining game, using a novel idea, smooth graphics and good sound. My one criticism is that the little figure looks more like Ken Livingstone than Bruce Lee.

Me Tarzan, you Cuthbert

Cuthbert in the Jungle is the most recent game in the Cuthbert series from Microdeal, and is by far the best in terms of graphics.

Using the joystick, you control Cuthbert, making him run to the right or left and jump. As he disappears off the screen on one side, he reappears on a fresh screen with some new hazard to confront him. These vary from logs and pits to scorpions, quokers and alligators. Occasionally, he thinks he's Tarzan and swings from carefully placed vines. Eventually, he discovers various treasures that have to be collected and brought back before the clock runs out. In order to reach the later stages, you have to acquire different skills such as calculating when alligator jaws are likely to open, how to catch swinging vines, etc. Each time you play, you improve and get closer to the treasures. This game is well worth adding to any collection.

If you feel you really have to be unpleasant to visitors from outer space, then Vultures from J. Morrison Mores is an ideal program. In this game you are given the opportunity to pit yourself against monstrous creatures that have apparently escaped from some cosmic aviary. A group of these evil birds starts in formation at the top of the screen. They then proceed to swoop down on to you, while depositing something unpleasant on your head. If you run into one, you will explode, so the only tactic is to try and shoot them before they get you.

As you mop your brow in relief at destroying this wave, some insect-looking eggs begin to hatch out revealing more nasties who leap down from their parents. Although you can never win, the path to destruction is accompanied by

Hit list

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Microdeal
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St Austell
Cornwall

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Phantom Maze
Cuthbert
in the Jungle
All £9.99

Salamander
Software
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Brighton
East Sussex

Franklin's Tomb
£9.95

Winterson
28 Uplands Park
Road
Girdford
Wiltshire

Ring of Darkness
£10.00

Programmers'
Quest
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Scotches Brook
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Ninja Warrior
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J Morrison Mores
2 Gainsdale St
Leeds

Vultures
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Premier
Microsystems
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Ampley
Leeds

Cribbage
£9.99

Wincham Micro
Systems
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Maze Editor
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£29.95

4 brief victories and should lure anyone who's had to visit the dry-cleaners after walking through Times Square recently.

Before you will be allowed into space to tackle such beasts as Vulures, you will undoubtedly need to show some sort of competence in flying spacecraft. This is why I have selected *Space Shuttle* from Microdeal. Standard flight simulators for micros are quite fun, but rarely behave quite like the real thing. Although they cope well with level flight, they don't produce the awful feeling in the pit of the stomach as you side-slip or get into a spin. *Space Shuttle* avoids these complications by enabling in the auto-pilot if you feel to operate the controls competently enough.

Starting with a weather report, the program takes you through four stages in a complete mission. As the display changes to a view of the instruments and the clouds outside, countdown begins and you rise majestically through a backdrop of stars. Your first chance to control something happens now, as you leave the launch rocket behind. You have to aim for the correct orbiting position, although there is a small amount of leeway allowed. The next part of the mission is to rendezvous with a satellite. Using a joystick and the keyboard, you have to use retro-rockets to align yourself neatly into place. Once you are close to your target, the doors have to be opened in the loading bay, and the robot arm extended to the satellite which is then packed away in the cargo hold.

As the doors close, you can fire forward thrusters to begin your descent through the atmosphere. The motors shut off and you control the final glide using only the joystick. Instruments are necessary in the initial stages, but soon the runway appears through the window, and the landing can be achieved visually.

After you land successfully — or crash — a debriefing report tells you where you went wrong during the mission. As you are a trainee pilot, the auto-pilot saves you from the worst errors, and you select points according to how close you came to the ideal route. It would be better if you could miss out the stages that you find easy and concentrate on the more difficult parts, but it is still an enjoyable program that needs careful thought as well as agile fingers.

Graphic horrors

One of the first games I saw that showed what could be done with Dragon graphics was *Phantom Slayer* from Microdeal. Adapted from an American program for the Tandy Colour Computer, this involves hunting round a hedge-lined maze while avoiding its unpleasant guardians. These are phantoms who spring out at you and are difficult to destroy even though you are armed with lasers. The best technique is to shoot, turn and run for cover behind a hedge whenever you see one. The graphics are excellent, showing not only the hedges at each location, but their changing appearance as you turn around. Instead of simply showing you 80 degree views, the scene pivots smoothly just in a way that must make other games writers

feel jealous. There is subtle warning of the approach of the phantoms as well as a training program to allow you to get used to the controls. There are two types of maze available, and the result is a realistic, high-speed game.

The last action game that I have included is *Berserk* from Dragon Data. I was nervous about including this program as it is available on a cartridge, and I still feel that these are overpriced. Whose most people might buy a good chess cartridge, or a utility package on cartridge, they would certainly be nervous at spending £20 on a game that could prove boring within a few days. *Berserk* happens to be my favourite from the games (the others are mainly different versions of Pacman), although I know several people who find it irritating beyond belief.

Steering a little man around a room, you have to destroy robots while avoiding electrified walls and something unpleasant called 'Eel Driller', who resembles a malignant medicine ball. As you rush to an exit, a new town scrolls across the screen, and the game increases in difficulty. Although fairly simple in concept, *Berserk* is fast and well-written.

M-C delights

There comes a time when the speed and facilities offered by Dragon Basic no longer satisfy the programmer, and he or she wonders if it might not be worth the effort of learning to program in machine code, or at least to use some micro-tuned-in Basic programs to speed the action up. Accessing the 68000 is easy on the Dragon, but simply entering line upon line of meaningless numbers is intimidating and time-consuming, which is why I have included in this selection of software, an assembler package, *Mace*, from Windrush Micro Systems. This cartridge also contains an editor and a monitor and is indispensable to the micro programmer. The documentation is 80 pages long and is fairly clear. Apart from general instructions, it gives a detailed breakdown of the 68000 instruction set, use of interrupts, and monitor and editor commands as well as examples. On plugging in, switching on, and entering BASIC 48152, you find yourself in editor mode. This gives you 20 options, including insertion and deletion of program lines, search and replace strings, load and save from tape, edit, assemble, go to system monitor or exit to Basic. There are 14 assembler directives and 14 assembly error messages, and the monitor allows breakpoints and jumps to sub-routines, both vital in final de-bugging. If you and up on a desert island with this cartridge and your Dragon, remember to ask Roy Parnley for either *Leventhal's* or *Zaxi* books on 6800 programming.

Although there are several code games available for computers, some of them seem to have little point. There is even a rather risqué version of strip poker available for the Apple. You choose which of two ladies you would like to play against, one rather incompetent and the other a world-class player. I'm not sure what you're expected to do as you gain points



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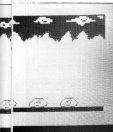
...and up on the map in Phoenix



Franklin's Tomb from Salamander, only...



... like to Premier at Crib, and then...



Warrior from Programmers' Guide

from the feeble player, but you'll have to enjoy humiliation quite a lot if all there in your back is the demon player seals five aces, but apparently this game seals quite well in the States.

If you are going to play cards, then you need to find a game that is fair for the computer to play. One such game is *Cribbage* from Premier Microsystems. In this, you are each dealt six cards, of which two must be placed on the discard pile. The next card is turned up to show its face. The discarded pile makes up the 'crib', which is placed to one side. Using the cards in their hands, the players take it in turns to place cards in a pile adding up the running total all the while. Runs and deuces score points, as does making 15 or 31. The total must not be higher than 31. When this point is reached, the dealing starts again. When all eight cards have been played, the players try to make 15 from their own cards (including the up-turned card on the top of the pack). They take it in turns to add the crib score to their own. Scores are usually kept on a written board with holes in for matchsticks. The winner is the first person to move five or ten matchsticks around the board.

The display is very clear, with the cards shown along the top of the screen, and the reaction times are fast. Although I prefer playing this game in some tiny pub out in the country with a pint of Wadworth's 50¢ close at hand, this program is as good as you could get on a computer, and of course, the Dragon doesn't make you buy the next round if you lose. (Well, not yet, anyway.)

As with arcade games, choosing a favourite adventure game is very much a matter of personal choice. I enjoyed *Madness* and the *Minotaur* and the more recent selection from Dragon Data, probably because they are all clearly influenced by the *Crowther* original (which I still enjoy playing occasionally). The two that I have included however, are *Ring of Darkness* from Wimersoft, and *Franklin's Tomb* from Salamander.

In the dark

Ring of Darkness combines text with graphics and a *Dungeons and Dragons* type character choice at the start. After choosing whether you wish to be human, elf or dwarf as well as wizard, thief or warrior, you set out across a map of the terrain. Clearly shown are all the popular tourist places, such as lakes and towns. As you make your way using the cursor control keys, you soon discover that fellow travellers are anything but friendly. In fact the sooner you start thumping them, the sooner you begin to collect weapons, gold and experience, without which there is little point in proceeding further. Clearly, this game is not for the faint-hearted.

As you collect various possessions your food supply starts to run out. When you reach a town, you are shown a high-resolution plan where you can purchase food, drink, weapons, spells and even advice. At this particular stage in the Middle Ages, someone had even invented an early hovercraft, and if you have

enough money, you can add this to your set of belongings. Should you not be able to avoid the hidden dangers (I never could stand *Walter Gurney*), then you will die and be promptly resurrected. This will cost you some possessions, but not experience points, which are increased handsomely after this harrowing event.

When you are well-equipped, you can enter one of the underground mazes to continue your quest for wealth and fame. This necessitates loading in another program that displays the maze in 8-to-30, even allowing you to see the requisite creatures that jump on you. Should you wish to climb the ladder to the surface once more, you simply reload the original program, and your position and present state are merged into the new program. Since I first played this game, I have become more convinced that the extra features make it worth the rather high price of £10.

In the crypt

Franklin's Tomb is also rather more expensive than the average Dragon game, but it does come in smart packaging that protects the software and doesn't simply make it look more impressive, and it does contain a booklet. Most of the locations that are visited are drawn clearly in it, and there is an introduction that sounds like Olive James reading from Raymond Chandler.

The game is set in the crypt of a graveyard, and takes you through many weird locations, several of which are really today-tripped. The locations are connected logically, which means that map-making is not too much of a problem. Hidden in various places are objects and clues that are essential on the other side of the maze of tunnels. The screen is split up into three sections: location description, personal inventory of things you've picked up, and a list of available exits (start wincing when this goes blank!) There is a save file facility to save your present position or cassette, which is useful just before you launch yourself into the unknown. As this contains merely your present position and inventory, it only takes 20 seconds or so to load or save.

As you explore further through the tunnels, you begin to see the point of the game, and the location that you should be aiming for. When you reach there, you need to deposit certain peculiar objects that you have collected enroute. If you succeed in this, you are free to... go out and buy the sequel, *Lost in Space*. In spite of this rather uneasy trick, the game is fun to play, and although rather easy for experienced adventurers, most people should get a lot of enjoyment from it.

In the next few weeks, I hope to find what *San Diamonds* (the hero of *Franklin's Tomb*) gets up to in space. I did hope that he would reveal the phone number of his sister, Albi, but I fear this is not to be. I am looking forward to seeing what the next batch has in store for me too, when the review goes live at home, and I'm sure that I'll find programs that I'll wish I'd included in this selection. ■

ALTHOUGH THE DRAGON 32 has now arrived on the scene there is still no firm word from Dragon Data on official upgrades for your faithful 32. In the meantime independent sources are already offering ways of upgrading the 32 towards the specification of the 64.

The most immediately obvious way to add more memory to your Dragon is to fit the cartridge port area with RAM and this approach has been taken by Money Microsystems which manufactures a cartridge that can contain up to 14K of battery-backed non-volatile CMOS memory.

The module has full buffering on the data, address and control lines together with the necessary decoding circuitry and RAM. The version shown in Figure 1 has sockets for 6 x 2K chips but only two of these are fitted in this 4K example.

Either normal low-power or ultra low-power CMOS static RAM chips may be fitted, the only differences between these being the price and the power consumption. A NiCad battery is fitted which is automatically charged when the module is plugged into the Dragon and a memory protect switch is provided to prevent accidental read/write operations and also allow removal of the cartridge.

Advantage

One advantage of this system is that data in the cartridge will be retained as long as the battery power holds up. This retention time varies according to the amount of RAM fitted and the type selected but varies from 60 days for the 4K version with ultra low-power CMOS to 4-7 days for 14K with normal low-power CMOS. The cartridge area is not available directly to Basic and therefore a small machine code routine must be used to transfer data to and from the module although access times are very fast (about 50ns/CLK).

The module thus provides a virtually instantaneous method of storage and retrieval of data for the non-disk user who might find it particularly useful for temporary storage of programs under development. Another obvious use is holding utility programs and in addition the module could be used to simply provide extra memory for data or to transfer data/programs between Dragon computers.

Prices range from £40 for 4K to £52 for 14K of normal CMOS with prices for ultra low-power RAM being about 10 per cent higher. The main advantages of this method of adding memory are that data and programs can be easily stored for extended periods, and of course, as the case of the Dragon does not have to be opened, your original Dragon Data warranty is not affected. On the other hand, as CMOS RAM is still expensive it is inevitable that this upgrade is not cheap. In addition adding memory externally in this way does not allow the versatility of memory handling available through internal modifications.

Microcare of Rode Heath, Stoke-on-Trent (in connection with Microcare of Thane Villas, London) will carry out internal modifications to your Dragon to expand

Added RAM power

Keith and Steven Brain
*investigate the various
upgrades offered for your 32.*

the memory of your 32 to 64K (or 128K with a free copy of a FORTH implementation from us).

Microcare began its last year when partners Eric Brooks and Peter Beaton noticed a shortage of joysticks for the then new Dragon 32, and set about trying to fill it with their own product. With suitable encouragement they projected a modest rate of growth in the market but were actually amazed to find that they had to continually double and redouble their production rate to keep pace with demand until they have currently become one of the major suppliers to the trade in this area.

They then examined more exotic hardware projects for the Dragon and came up with a 64K upgrade for the machine, which has now been available for some months. Although this conversion has not been generally advertised, Microcare has now modified (over a hundred machines for enthusiasts who have mainly heard of their transplants on the grapevine).

The basic architecture of the Dragon hardware is very similar to that of the Tandy Colour Computer and a vast reser-

voir of technical information on this was already available in the numerous GoGo magazines from the USA. The principles of what must be done were therefore relatively easy to define.

As well as actually physically replacing the RAM chips it is necessary to rearrange the pin pads, rearrange the read/write lines to access the extra memory, and make a small number of physical links on the board. One of the first problems that they found when they came to upgrade Dragon 32s, was that there are at least seven significantly-different versions of main board, all of which need to be treated differently!

Although all versions contain 32K of user RAM this value is achieved in a number of different ways. Most Dragon 32s contain 16 x 16K RAM chips. Sixty versions have half of these on the main CPU board itself, with the second eight on a 'piggy-back' board mounted above them (Figure 2a). Later versions have all sixteen chips mounted on the main board itself. Smaller numbers of boards contain either 8 x 32K RAM chips or even 6 x 64K RAM chips. (Although in fact the 64K chips fitted in these cases are supplied to Dragon Data as only 'half-good' and only one side was actually connected to give 32K).

As none of these chips is socketed, it is difficult to remove them without specialist equipment, or a combination of a lot of patience and a reasonable amount of experience of desoldering. The Editor (who is very sensitive to telephone calls from irate parents!) insisted that we emphasise at this point that this is NOT a job to be done by a novice on the kitchen table whilst everyone else is busy watching Dallas.

Replacement

In each case Microcare replaces the existing RAM with 6 x 64K chips. Where 64K chips were originally fitted these are fitted and only replaced where necessary (you might even get a rebate). The standard of the conversion is very professional

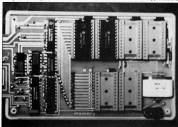


Figure 1. Money Microsystems' cartridge - up to 14K



Figure 2a: before the MOSCARE operation and...

and if you take a quick glance at the 'before' (Figure 2a) and 'after' (Figure 2b) photographs you are very likely to get them the wrong way round, as in this case there are actually fewer chips after modification.

The conversion has been designed so that 'permanent' physical modification of the board is minimised, although with some versions some in-situ cutting on the main board is unavoidable. Where particular pins need to be disconnected this is arranged by fitting wire-wrap sockets to the original board locations and then clipping relevant pins on these, rather than mutilating the ICs themselves. Each machine is thoroughly tested by MOSCARE both before and after modification.

Unauthorised

Of course, this unauthorised work will void your Dragon Data warranty but, if you own one of the many Dragons which are now more than 12 months old, this should not worry you too much as Peter Beeson claims that no reputable Dragon Service Agent should have difficulty dealing with the modified board. The conversion is only available direct from MOSCARE, which has so far been operating a virtual return of post service.

The manual provided with the upgrade was originally designed for the enthusiast who already had a reasonable amount of technical knowledge but it is currently being revised as the potential readership has widened. After conversion, the modified Dragon 32 contains 64K of RAM accessible to the user in a similar way to that in the Dragon 64. On powering the machine up, it starts, and behaves, in exactly the same way as a standard 32.

In this mode the area from \$B000 to \$BFEFF is allocated to the Basic ROM and cartridge port as usual (map type 0). Now that you have the upgrade you can switch to map 1 by simply altering the appropriate register in the SMI (Synchronous Address Multiplexer) chip by POKEing any number into location \$BFFD0. This gives you direct 64K of available RAM but absolutely no control over this area as the ROM memory area

has been switched out so nothing is giving instruction to the CPU.

Clearly this is of no value whatsoever unless you take steps to regain control. To be able to run Basic in 64K mode you must copy the contents of the ROM into RAM. MOSCARE provides a machine code ROM-SHIFT program in the basic price which carries out this task for you automatically when you LOADAM it as usual in 32K mode and then EXECute. This gives you a copy of Basic in RAM in exactly the same position as it normally occupies in ROM. This will run all existing Dragon 32 software as usual. However, in addition, the old cartridge port area now contains almost 16K of RAM which can be accessed by the user.

The only drawback is that as this area is above Basic it is not recognised by the system and can only be reached by machine code routines, or PEEKing and POKEing from Basic. As the Basic is running in RAM it can be modified (customised) by the user but on the other hand the speed-debating POKE \$BFFD0,3 will

	MAP TYPE 0	MAP TYPE 1
\$BFFFF	IO only	IO only
\$BFEFF	Cartridge Port	
\$B0000		
	Basic ROM	User RAM
\$B000	User RAM	
\$BFE00		
	Video Display	
\$B000	System use	
\$BFE00		
\$B000		



Figure 2b: afterwards - fewer chips after the modification

not now work as this does not operate on RAM memory. Of course you can use the copy of Basic in RAM to LOAD another language (such as PORTH) and then call up the new language which can even use the Basic RAM area as workspace as this is no longer required.

Problem tackled

As we described in last month's issue of Dragon Data, Dragon Data has fitted two copies of the Basic ROM to their new 64, the second being a reassembly of the security code at higher locations to get around the problem of the code being position-dependent. MOSCARE has solved this problem in a slightly different way by also having available a ROM-SHIFT program for an extra £10-12 which first relocates the Basic ROM contents to the top of memory and then operates all the absolute addresses in this area to the correct values now required, to give you a full 48,960 of memory directly available to Basic (as on the real 64). It is not clear at this point how compatible this version is with the second ROM on the Dragon 64 but, for example, it will not contain the new key autorepeat routine implemented on the 64.

The manual points out that it may be possible to copy ROM cartridges into RAM but takes pains to point out the legal implications of such action. It certainly seems morally justifiable to us for a user to take such action with his own cartridges, so that he can take full advantage of his machine, and in any case the 'hot-shot' cartridge manufacturers often include 'anti-pirate' routines in their ROMs which write garbage all over the code if it is transferred to RAM to prevent just such copying! Where a utility ROM cartridge is integrated with the Basic it is usually necessary to use a modified version of the ROM-SHIFT program to move the routines to RAM.

MOSCARE has been running the 64K upgrade in conjunction with the Premier Casseus Delta disk drive system for some time but compatibility of the official DragonDOS has not yet been thoroughly tested. As long as Delta is operated from the ROM in the cartridge it functions ►

WINDRUSH MICRO SYSTEMS

**MACE**

EDITOR
ASSEMBLER
MONITOR

CONCLUSIONS

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[illegible]

14. DISCUSSION The purpose of this study was to determine the effect of the use of the computer on the learning of the concepts of the cell and the process of photosynthesis. The results of the study showed that the use of the computer had a significant effect on the learning of the concepts of the cell and the process of photosynthesis. The use of the computer was found to be an effective method of teaching the concepts of the cell and the process of photosynthesis. The use of the computer was found to be an effective method of teaching the concepts of the cell and the process of photosynthesis. The use of the computer was found to be an effective method of teaching the concepts of the cell and the process of photosynthesis.

The SECRET was not a new concept, requiring no change orders. Secret is classified into a range of orders, with the highest of secret that the user can be given. The 1st level of listing of secret is secret, followed by restricted, limited and public releases. The 2nd level is secret and restricted and the 3rd level is secret and restricted after consulting a classified, a restricted, a limited and a public release.

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Age Group	Percentage
18-24	10
25-34	25
35-44	40
45-54	55
55-64	70
65+	85

[illegible]

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D-RING

TRACER
MONITOR
DISASSEMBLY

250 251 252

PROPERTY OF: CUSTOMER

0-0000 is a complete software description of the 0-0000. This includes 0-0000 to software complete control of the new 0-0000 plus 0-0000. Includes full and complete code for programming. Program code 0-0000 (0-0-0000) and 0-0000.

NOTE TO READER: This is a printed version of a text that contains a large amount of text. It is not intended to be read as a continuous text. It is intended to be read as a series of paragraphs. The text is divided into sections by headings. The headings are: 1. Introduction, 2. Background, 3. Methodology, 4. Results, 5. Discussion, 6. Conclusion, 7. References, 8. Appendix, 9. Glossary, 10. Index. The text is divided into sections by headings. The headings are: 1. Introduction, 2. Background, 3. Methodology, 4. Results, 5. Discussion, 6. Conclusion, 7. References, 8. Appendix, 9. Glossary, 10. Index.

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STATE TO CONDUCT. During period from 1970 to 1971 the United States Agency for International Development (USAID) conducted a study of the situation in the country of the USSR. The study was conducted by the USAID Office in Moscow. The study was conducted by the USAID Office in Moscow. The study was conducted by the USAID Office in Moscow.

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BUG ZAPPER

WITNESS: _____

979.05

Abstract

[illegible][illegible]

1990) suggested, we tested three models: Model 1 (no interaction), Model 2 (interaction between age and sex), and Model 3 (interaction between age and sex and between age and season). We used the Akaike's Information Criterion (AIC) to compare the three models. The model with the lowest AIC value was considered the best model. We also calculated the Akaike's weights for each model. The Akaike's weights represent the probability that a given model is the best model. We used the Akaike's weights to calculate the probability that a given model is the best model. We used the Akaike's weights to calculate the probability that a given model is the best model.

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6809 FLEX THE
SOFTWARE / HARDWARE

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DOI: 10.1002/for

[illegible]

FIG. 10 is a schematic of a modified feedback control system. FIG. 11 is a schematic of a modified feedback control system.

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[illegible]

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A breakdown of machine code

Bruce Devlin gives some hints on writing your own machine code programs

MOST PEOPLE are against learning machine code because they think of it as being too advanced and too difficult for them. What they don't realise is that machine code is only as difficult as you want to make it. The only clunky thing about machine code is that the machine is running fast and very fast with no safe BREAK key to help you out when things go wrong (as they inevitably do). The correct approach to writing a program will not eliminate all the tedium but it will make it a lot easier and quicker to write.

The first step is to sit down with a pencil and paper and decide on what the program will do. Once you have thought through just about all the possible errors somebody using your program could make, the next thing to decide on is what modules you are going to have. A module is a sub-routine (or set of sub-routines) which performs a certain task. For example in a typical arcade game modules and sections would be:

1. Move the ship 1/2 character cell to the left or right.
2. Move the bullet 1/2 screen up the screen.
3. Move the bug in a random direction, change its colour and check to see if it has been hit by the bullet.
4. Create the screen in black.
5. Print the message text.
6. Generate a random number.
7. Keeps the game ready for another go.

Individual modules

The individual modules should now be planned. Do not write any code at this stage. Merely write down what actions cause which things to happen and what errors you must check for. Once the modules have been planned the next thing to do is plan the section which links the modules together. (If your choice of structure for your modules was good then this will be very simple). Finally write the program down on paper and then enter it into the computer. This way you will eliminate most errors before they even reach the keyboard, let alone crash the machine and lose all your hard work.

The benefits of modular programming for machine code cannot be too highly stressed. Each module should be developed individually before being run with the rest of the program. Although it may not seem like it, this is probably the quickest way of getting an idea out of your head and on to a micro.



FIG. 1



FIG. 2



FIG. 3

Decisions while running

Now that you have an idea of how to write the program you will see that decisions have to be made during the running of it. These decisions can be made with the use of the CMP (Compare) function, but many tasks require the use of the logic group of functions.

Logic deals with two false values which can be represented as 0V OR 0V OR

electrically and as 1/0 in binary. As there are only two states to be represented, the most compact way of storing binary values is as one bit. This means that eight logic values can be stored in one byte. The question you should now be asking is: how do you do things with one bit? In reality this isn't possible, the electronics always handle eight bits at a time, but with simple tricks with numbers and the knowledge of a few logic instructions, you can handle one, two, three... up to eight bits at a time.

The instructions you need to know are AND/OR/NOT/SET. Each of these functions requires two inputs, each of which is one byte. One of the inputs is either the A or B register so you must load one of these registers with a number to begin with (this number could be the result of a calculation). The second number can be addressed any way you like (ie memory, indexed, a number etc). The ANDS then takes each byte and lines up the corresponding bits in each so that bit number 0 of each byte is AND/OR'ed together and stored in bit 0 of the accumulator, bit number 1 of each byte is AND/OR'ed together and stored in bit 1 of the accumulator and so on. How each of these functions works is given in the truth tables in figures one to three.

A few examples of these functions should prove the way to showing what use they can be. A random example:
 LDA #55 — put 55 into A accumulator
 EDRA #53 — exclusive OR with the number 53

To work out the result of this calculation first convert into binary.

55 = 0101 1111

53 = 0011 0101

Exclusive OR'ing each bit gives binary 0100 1010 = decimal 14 (AH).

An example which will prove to be more useful is the following.

LDA @NUMBER — A = contents of memory location @NUMBER
 ANDA #32 — A = A ANDed with 32

Let's do the sum with two possible values of @NUMBER: 127 and 255

127 = 0110 1111

32 = 0010 0000

AND = 0110 0000

255 = 1110 1101

32 = 0010 0000

AND = 0010 0000

You can now see that the result will be 32 if bit number 5 is set and 0 if bit number 5, counting from zero starting at the B

4 right) is not set. We have just done an operation on a single bit. To test to see if a bit is set use the AND instruction and the numbers 1,2,4,8,16,32,64 and 128. The AND instruction does have its drawbacks: it changes the result of the register permanently. This is where the BIT instruction comes in. BIT will do exactly the same as the AND instruction except that the result is discarded and the flags only are set (remember the similarity with CMP and SUB).

For example, when testing to see if the keys "B" and "Z" are pressed on the keyboard, a mask is put into the keyboard column output, having only one of its bits as zero. The rows are then tested (any row having a zero bit has a key pressed). Assume the A accumulator contains a row of data. If bits 2 or 5 are set then "B" and "Z" respectively are being pressed.
BITA #2 — check for "B"
BITA #4 — check for "Z"
BCC @PRESS — jump to @PRESS if bit is zero
BITA #4 — check for "B"
BCC @PRESS — jump to @PRESS if bit is zero

Zero result

If the first instruction was AND (rather than BIT) then BITA 4 would always yield a zero result because the AND instruction would have cleared all bits except possibly bit 5. Be careful of this.

Of all the uses of the OR instruction, setting bits must be one of the most common. With the AND instruction, whenever there was a zero in the data, there would be a zero in the result. With the OR instruction, whenever there is a 1 in the data there would be a 1 in the result. A good example is text mode graphics. To generate a random graphics shape from a random byte in the B accumulator we must first make sure that the top bit (bit 7) is set, otherwise we may get a text character (CHR (128) up to CHR (255) are the graphics characters).
ORB #128 or B with 128 decimal = 80 hex

Getting adventurous

We now have a random graphics shape. Let's be more adventurous and create a random coloured fixed shape. In text mode the bottom four bits control the shape and the top four bits control the colour. To add a shape to our random colour we must first turn out the shape that is already there.
ANDB #80 — clear lower 4 bits

You will notice that I am now using HEX. This is because 1 hex digit represents either the top or bottom four bits. Using HEX is, therefore, much easier to manipulate the bit patterns without writing them out. Now let's add a shape to our colour. The number 5 is the shape.
ORB #5 — add the shape

These three instructions are all that is needed.

Another use

Another use of this bit manipulating is to quickly read the text screen cursor position. If D contains the address of the text cursor on the screen then the lower 5 bits will give a value of 0-31 which will be its horizontal (TAB) value of its position.

LDD #80 — load tenth cursor address
ANDB #31 — clear all bits of B except lower 5

B now contains the TAB position.

The EOR instruction can be used to invert bits. If a 1 is present at any bit position then the EOR instruction will invert it.
LDA #80 — binary = 0110 0001
EORA #2 — after this A = 0110 0001
EORA #2 — 2nd time A = 0110 0001

This is because 2 in binary = 0000 0010 so bit number one was inverted every time. This is used in the Dragon to oscillate the speaker by oscillating a bit in an output port.

Shift instructions

A group of functions complementary to the logic instructions are the shift instructions. As the name implies these instructions shift a byte one bit to the left or right. The bit that drops off the end is stored in the carry flag in the Condition Code register. The instructions available are as follows:
ASLA/ASRA — arithmetic shift left/right accumulator (could be B)



LSLA/LSRA — logical shift left/right accumulator (could be B)

ROLB/RORB — rotate left/right accumulator (could be A)

By leaving off the last letter which specifies an 8-bit accumulator, it is possible to use any of the above instructions directly on memory (eg ASL, ASRA will perform ASL on location \$B00A1 and store the result in location \$B0A1).

To see how they work imagine that a) are bits with values 1 or 0.

Shift left: before [a b c d e f g h] carry = 1

after [b c d e f g h] carry = 0

The "f" bit will depend on which of the shift instructions was used:
ASL: 1 = 0
ASL: 1 = 0 } ASL and LSL are identical
ROL: 1 = 1

For example, let B = 118 decimal = binary 0111 0100 and the carry flag = 1
After ASLB: B = 1110 1000
LSLB: B = 0011 1000
ROLB: B = 1110 1001

Note that both ASL and LSL are equivalent to multiplying by two (B = 232).

Shift right: before [a b c d e f g h] carry = 1

after [a b c d e f g] carry = 0

The "a" bit will depend on which of the shift right instructions was used:

ASR: 1 = a } ASR and LSR are NOT
LSR: 1 = 0 } identical

ROR: 1 = 1

For example, let B contain -41 decimal = 1101 0111 (= 215 unsigned) carry = 0
After ASRB: 1110 1011 carry = 1
LSRB: 0110 1011 carry = 1
RORB: 0110 1011 carry = 1

Note that ASL is equivalent to dividing a signed number by two — B now contains -20 which is INT(-41/2). LSL is equivalent to dividing an unsigned number by two — B now contains 107 which is INT(215/2).

One of the most exciting uses for these shifting instructions is for high resolution graphics games (see listings). To move a sprite (small character such as a spaceship) smoothly across the screen, a picture must be shifted between bytes. On the Dragon colour pixels are represented by two bits in a byte (4 pixels to a byte)



where the bit pairs are 00,01 and 10,11 are the numbers of the colour in that pixel. This means that if a = 3 then colour 3 will appear on the screen.

If we take a 16-bit number asb0 c000 d000 and shift it to 00aa b000 d000 d000 it would appear that our picture had shifted one pixel to the right. A further shift would give 0000 asb0 c000 d000.

To accomplish this the 16-bit number would be in the D accumulator. The instruction LSRA would drop the end bit into the carry flag and shift a 0 into the left hand end. RORB would then shift the carry bit into the left hand end of the B register. Repeating this would give us the required shift. This is the basis on which the program moves the 4 x 4 colour sprites left and right.

Addressing modes

There is little about the 6502 mentioned so far that is vastly different to any other processor on the market. What makes the 6502 such a powerful and flexible machine is its addressing modes. I would take a complete book to describe the operation and application of each mode so here the basic functions of each mode will be given. The names of the modes are not important but the way they work is.

Immediate instructions such as CLRA, NEGAB, INCB, MVA, ASB (B = B + 8 when B = 0 - 255). These instructions do not need any other data except for the register which is given with the instruction.

Immediate instructions such as ADDD #4, ORB #F5, CMPS #F000. Here the data is a number in hex or decimal (some assemblers allow ASCII codes to be given as data). For example ADDD 4 will add 4 to the contents of the D accumulator.

Extended instructions such as COM \$7801, STX \$100A, JMP @START, ADD @VALUE. Here an address is given for the instruction to use. In this case COM changes the contents of location \$7801. JMP is the address given by the label @START, and the contents of the location @VALUE and @VALUE + 1 to this.



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Open already typed in right... ...the computer screen is ready to go.

EN 1294

Direct: This is similar to Extended except that only the lower byte is given with the instruction. The upper byte is contained in the DP (Direct Page) register. Using this addressing mode gives faster and smaller programs. For example:

LDA #B0 — A ← B0H3
TFR A,DP — Load this into the DP register
LDH @B0CN — Load B with @B0CN
using direct addressing.

The above example would only work if @LOOP was on page \$F40 (ie the top two bytes of its address were \$F40). Care must be taken that DP is correct. For Basic the DP is 0. Make sure this is so if you return to Basic.

Indeed, there are many different types of indexed addressing most of which can be tailored if desired (see below). The register R in the examples below can be X, Y, Z, or R.

JM addressing: LIA *B* is an example. Here the *B* register contains the address at which the byte we wish to load *A* with can be found.

R/R addressing: STB-LX is an example. This is a modification of R addressing. Now the address is given by R + (contents of R). In this example if R contains 8440 + 20, the B will be stored in location 8460 (20B). R can be any number between -32768 and +32767.

r/R addressing: Rn.R is an example. Here the number n is in the last case is replaced by a register r which can be A, B, or D. The contents of this register (a signed number) is added to the register R to get the final address.

E++, **E+++**, **additionnel**, **insubordonné**

This is the same as *R* addressing except that after the instruction has been executed, the *R* register is incremented by either 1 or 2 depending on the number of plususes. CMPR, Y+ will compare *R* with *m*, and then add 1 to *R*. LDUR, S++ will load *U* from the system stack (adding 2 to the stack pointer so that it points to the next item down in the stack).

—R, —R addressing (autoincrement): This is similar to autoincrement (except that the register is incremented) before the instruction is performed. STB, —U will store the B register on the User stack and leave the stack pointer pointing to it. (The stack pointer points to the location on top of the stack, up at address 11 or 12).

n,PCIR addressing (program-counter relative): This addressing mode is one that is normally only found in the instruction sets of micro and mainframe computers. To the programmer it means that you can write a program which will work whenever you put it in memory.

Indirect addressing: This is used whenever the data is not in the register. The following is an example:

LDY 2,4 — load Y from the locations 2,4 and 3,4

This can be done much more quickly and compactly by using `LDA(2,8)` which means load `A` from the address at `2,8`.

Other addressing modes can be used with the indirect addressing such as INC, ISL, SUBA (inADDP), STS [-/+]
[Note that if indirect addressing is used then double increment/decrement must be used due to an address being 2 bytes long]

The instruction `LDAR R = X,Y` (or `ST`) is available for use with all the indexed addressing modes. With this instruction, instead of calculating the address of the data and then loading/storing etc., the calculated address is loaded into the register. For example:

LEARN 4, Y — will load X with the value of Y

LEAU 1,U — will load U with the value of U + 1 (ie $U = U + 1$).

LEAVE IN — will load *T* with the value of 0 + *T* where *N* = -128 to +127

Note: Remember that $LEAS(1,1)$ is the same as $LEAS(1)$. (Can you think of other instances?)

The last three instructions that are of everyday use are the subroutine instructions. These are `JSR`, `BSR` and `RTS`. Jump to subroutine, Branch to subroutine and Return from subroutine. `JSR` and `BSR` first put the program counter on the stack (`DIPIC` -- `S` is how the instruction would be written if edited). `RTS` takes this value off the program counter and goes to the address `DIPIC` `S`++ as before. It is therefore very important that in your subroutines, if you use the stack, you return it to the way it was when the subroutine was entered. Not doing so is one of the most common ways of crashing the machine.

You should now be at a stage to go out and buy an assembler and start playing with machine code. Once you have a bit of experience in this you will be writing programs you never thought were possible. You will be surprised at how easy it is.

(Listings courtesy of the Micro Centre in Rugby.) ■

[illegible][illegible]

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May I finally thank you all for the support you gave to my original appeal for recruits to help in the fight against the **DRONE** armies, and even now, new volunteers are still welcome to join in this valiant crusade!



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200 IF TIME=0 THEN GOTO 210
210 PRINT "PRESS [ENTER] TO START"
220 IF TIME<0 THEN THEN GOTO ELSE TIME=0
230 GOTO 1000000
240 IF A=0 THEN GOTO 250 IF A=0 THEN GOTO 260 THEN GOTO 270
250 PRINT "A=0"
260 IF A=1 THEN GOTO 270 IF A=1 THEN GOTO 280 GOTO 290
270 PRINT "A=1"
280 IF A=2 THEN GOTO 290 IF A=2 THEN GOTO 300 IF A=2 THEN GOTO 310
290 GOTO 320
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THE ALLIANCE

It's actually possible to use a technique called *feature engineering* to get an interesting new feature. I actually learned this technique in a seminar about machine learning for the stock market. It's called *feature engineering* because you're engineering features before they are given. You maximize the use of the data by doing things like normalizing, standardizing, taking the log, and taking the square root, doing sampling from a distribution and parameterizing it, etc. So, with a couple of simple words (which I will use later), the game comes down with an infinite training set (or a finite training set) and a test set.

FREE TRAINING

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buying, selling, mortgaging, etc. The program makes full use of the Dragonair color facilities and incorporates some original graphics and sound effects, still options for 2-4 players, completely variable instructions and the Dragonair banner. The game is terrific. For all the money and there will be no missing credits!

100 *Journal of Management Inquiry* 18(1)

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Add some polish to your program

How do you make your program stand out from the rest? Margaret Norman reveals the finer points of program presentation with 10-Pin Bowling.

MOST COMPUTER GAMES are variations on a very few themes — copies of well-known arcade games, board games, card games and so on. So what can you do to make your version stand out from the crowd?

Well, the basic mechanics of the game are obviously important and if you can introduce an original twist, that's fine — but the way in which the game is presented is bound to be a major factor in sorting out the successes from the also-rans.

Let's look at some of the minor details you will need to pay special attention to — the title sequence, instructions, high-score tables and so on — and see how some of them can be applied to one game, a computer version of 10-pin bowling.

First impressions count

First impressions always count for a lot, so the program should begin with an attractive sequence. This is especially important if the initialisation of program variables takes a significant length of time; you don't want to leave the player staring at a blank screen while this is being done.

Obviously the sort of title page you can produce will depend to some extent on the amount of memory space available, but even if you are restricted to the text screen there is no need to settle for just printing the program name in the middle of it. Here is just one alternative to that:

```
10 CLS
20 FOR I=1 TO 10
30 READ A$:A=ASC(A$)
40 FOR J=0 TO 9
50 POKE (1000+32*J+I), A:POKE
  (1000+32*J+9), 199
60 NEXT J
70 POKE (1000+32*9+9), A: NEXT I
80 DATA H,A,M,E,D,O,P,T,R,E,D,A,M,E
90 FOR CL=0 TO 3000: NEXT
```

There are plenty of other options, of course; you could SET each part of the screen to a random colour before printing the title in the middle, or perhaps produce a picture, using the STIRHCS command, with the title printed on it.

If you can use HiRes graphics, then obviously the scope is much greater — you can DRAW your title in any size letters, upper or lower-case, in any colour, and produce an elaborate pattern or picture as well. If you want to SET pictures into arrays as part of the program initialisation, then it may be a good idea to incorporate these into your title page.

The bowling program shows one example of this — the words "10 PIN BOWLING" are DRAWN on the screen in yellow against a blue background, with the letter I in BOWLING replaced by a skittle, then the ball is used in the game to send the ball to be used in the game to send the skittle down. (Lines 40-180.)

You will notice that the SCREEN has not been set until after the letters and skittle have been DRAWN, so the picture will appear all at once rather than 20-by-20. The colours used have been chosen so that they will show up in black and white as well as in colour, for the benefit of those people who don't have colour televisions to see with their computers — red letters against a blue background, for instance, will not show up in black and white.

Another common element of the title sequence is a signature tune. If you can think of an appropriate song to go with your program, then you can use part of that — if not, you can always make up some music for yourself (or if you're not musical, just try a few random combinations of notes and see which sounds best, as I did).

Joystick alternative

If your game uses joysticks, then see if you can add a few extra lines to enable it to be played using the keyboard instead, for those people who don't have joysticks. If you do this, then it's a good idea to ask whether joysticks or the keyboard are going to be used straight after the title sequence, before the instructions, so that you can give separate instructions for each. You can see how to do this in the bowling game, where alternative versions of the first two lines of instructions are given.

If the instructions for your game are very long and complex, or if memory space is tight, then you may prefer to provide written instructions instead of putting them all in the program, but there's a lot to be said for at least putting brief instructions in the program itself, in case the written instructions get lost.

Optional instructions

The instructions should be made optional, so people who have played the game before can skip them, and each segment should be concluded with a request for a keypress, so people can take as long as they want to read it (see lines 210-220, 300, 340 of my program).

Try to make the instructions as clear and concise as you can, and make sure all the words are spelt correctly — it's worth spending a few minutes checking any you're not sure of in a dictionary. Test them on a friend — if they have any questions to ask you about the game after reading them, then a re-write may be called for.

The instructions sequence will often be followed by requests for input — selection of the number of players, level of difficulty etc. Whenever you ask for some input, try to make clear what form you want it in and what range of values is acceptable, and put in a check to see that the input does fall within the given range (see lines 500, 610 for an example of how to do this).

Levels of difficulty

The bowling program has only one level of difficulty, but with most games it is possible to cater for a number of different skill levels. However, there is little point in having dozens of levels of difficulty if the differences between them are only very slight; for most games, ten levels should be plenty. Generally, level 1 should be the easiest — if you have written your game so that, say, level 10 is the easiest and level 1 the hardest, then reverse the order with "INPUT L:L=10:L".

There are lots of different ways of varying the difficulty of a game, though obviously only one or two of these will be used in any particular game. If the game is fairly fast, you can introduce a variable delay loop (eg FOR CL=0 TO 10*(10-L):NEXT CL, or the number of "badlines" is too slight, evaded or shot, the accuracy of shooting required to score a hit, the time limit or the time the computer can take choosing its next move can be changed. Instead of allowing the player to choose the degree of difficulty at the start of the game, you can, if you wish, increase the difficulty gradually as the game progresses.

Next, the scoring. If you are writing a computer adaptation of a well-known game then it is generally best to stick to the scoring system of the original version as far as you can. If you can choose the method of scoring for yourself, however, there are several factors to consider.

Firstly, the highest score should normally be the best — so for a game with a time limit, for instance, base the score on the time left at the end of the run rather than the time elapsed. ■

• **Secondly**, if you want to include a high score table your score will have to be a single number, not say, a number of points scored and a number of penalty points incurred. You will also have to make the score depend to some extent on the level of difficulty if you want it to be a fair reflection of the player's skill.

On-screen scoring is often useful; if your game uses low-res graphics then this is comparatively easy to include, but if it is an HDV then it is rather trickier. Linux 2000-2005 of the bowling program (and lines 540-550), which defines the strings used in the `DPBW` command) shows how to `DPBW` a three-digit number on the Hires screen; this routine could easily be modified to deal with larger numbers. (Here the score is `DPBW` on a scoreboard, so the initial `X` and `Y` co-ordinates have to be calculated — for on-screen scoring, they will normally be fixed.)

Saving the high seas

The high-score table routine (lines 1128-1180) uses a simple sort to place scores in their correct positions in the table. The high scores will, of course, be lost when the computer is switched off; the only way

of avoiding this is to **SAVE** them on tape in a data file, which would involve adding two more subroutines, one to be called up at the end of the program to **SAVE** the data on tape and the other at the start of the program to **LOAD** it again. The same technique could be used to **SAVE** a game, which is likely to last a long time. I will leave you to work out for yourself precisely how to do this.

10-Pin Bowling

This is a fairly easy game, which my children (aged seven and eight) greatly enjoy. The most important part of the program is the session (lines 1500-1750) which determines which states will be knocked down — producing similar results to a “real” bowling game requires some ingenuity. The process has been simplified by re-numbering the skittles:



Abstract

The ball can hit a skittle in several different places, so the function in line 1540 produces a value of `hitSQ` between 1 and 7. This value is then used in an `ON...GOTO` statement to determine which other skittles will fall. `hitSQ` has a total of 11 possible values. 0 if the skittle is left standing, 1-7 if it is hit by the ball, and 3,6,8,9 or 10 for an indirect hit. A strike can be obtained by hitting the leading skittle (line 1) slightly off-centre, and is rewarded by the screen flashing different colours and an anamorphic sound.

The graphics used for the ball and obstacles have been kept simple, to ensure that the game will run at a reasonable speed; much more effort has been put into drawing the scorecards (lines 848-945), which bear a fair resemblance to the real thing. The vector of the program which DRAWS the scores on the scorecards is also fairly complex — if a strike or spare has been scored, then the score for the frame cannot be entered immediately, and APLUFF is set to 1 or 2 to indicate the number of balls to be played before it can be entered (lines 5565-5595).

```

10 REM 10 PIN BOWLING      20 REM BY MARSHLET NORMAN
30 REM TITLE SEQUENCE
40 PRINT:;:;FCLG3
50 DRAWNEM 5,40IC28DZ09PBLZOR6A02DL1A":'D
60 DRAWNEM 5,110ILC0R20B1SL2OU15BR30B20B31OU30BP700GLCO":'P'D
70 DRAWNEM 5,130IR2MF4DI20MFL2AF4BI20AL24M0MR30B20OVL20U4-00R30B3AF4BBE4ML3LFAF
80 LUL3LBN1SD4GB20BRS3AU4-G0SF3020LA0B00L20B40R2BLCOX10":'BOALNO
90 DRAWNEM161,1401BA02CF4BE4G02H4":CORCLE 1AB,134),9,2,PALNT 14S,134),2,ZPALNT
11S,150),3,2
90 SCREEN1,0,PLAY"V3110REDEFP00FE000"-IGQTD 2=0
100 BI=14S:BY=12:SOUND50,1:SOUND4S,1
110 FOR I=0 TO 44
120 PUTIBI-10,BY=100-(80+10,BY=101,B,PSET
130 PUTIBI-10,BY=100-(80+10,BY=101,BL,PSET
140 IF I=28 THEN SOUND25,1:SOUND23,1:SOUND24,2
150 BY=BY+4    160 NEXT I
170 FOR DL=1 TO 20:NEXT
180 CLS:PRINT:INPUT"DO YOU HAVE A JOYSTICK Y/N?"
190 IF OK="Y" THEN 2=0 ELSE 3=1
200 REM INSTRUCTIONS SEQUENCE
210 CLS:PRINT:INPUT"DO YOU WANT INSTRUCTIONS Y/N?"
220 IF OK="Y" THEN 600
230 IF 2=0 THEN 340
240 CLS:PRINT:"MOVE THE GREEN BALL UP AND DOWN WITH THE RIGHT JOYSTICK."
250 PRINT:"PRESS THE FIRE BUTTON TO BOWL WITH THE YELLOW SHITTLES."
260 PRINT:"EACH GAME CONSISTS OF 10 FRAMES."
270 PRINT:"FOR EACH FRAME, YOU HAVE TWO     BALLS WITH WHICH TO KNOCK DOWN AS MANY
Y SHITTLES AS POSSIBLE."
280 PRINT:"YOUR SCORE FOR THE FRAME WILL     NORMALLY BE THE NO. OF SHITTLES KNOCKED
DOWN."
290 PRINT:"IF YOU KNOCK DOWN ALL 10 WITH   THE FIRST BALL (A "STRIKE") YOU WILL S
CORE 10 + YOUR SCORE FROM THE NEXT TWO BALLS,"
300    INPUT:PRESS enter TO CONTINUE"IGN
310 CLS:PRINT:"IF YOU KNOCK DOWN ALL TEN  SHITTLES WITH 2 BALLS (A "SPARE") YOU
WILL SCORE 10+ YOUR SCORE    FROM THE NEXT BALL."
320 PRINT:"IF YOU GET A STRIKE OR A SPARE  IN THE TENTH FRAME, YOU WILL BE GIVEN
AN 1TH FRAME (AND A 12TH, IF NECESSARY)."
330 PRINT:"THE MAXIMUM SCORE IS 300 (12  STRIKES)."
340 PRINT:INPUT:PRESS enter TOCONTINUE"IGN
350 GOTO 600
360 CLS:PRINT:"MOVE THE GREEN BALL UP AND DOWN WITH THE ARROW KEYS."
370 PRINT:"PRESS THE SPACEBAR TO BOWL AT   THE YELLOW SHITTLES."
380 GOTO 340

```

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```

1070 IF A$PL,F$>0 THEN 1090
1080 R=F$SCORE*2040
1090 FOR DL=1 TO 3000:NEXT
1100 NEXT PL,F
1110 REM END OF GAME
1120 CLS:PRINT#40,"FINAL SCORES:"
1130 FOR I=1 TO P
1140 PRINT:PRINT"PLAYER"$(I) " " $(I),100
1150 IF $(I,10)<$(C(10)) THEN 1240
1160 INPUT"HIGH SCORE: WHAT IS YOUR NAME " $(NAME$(I))
1170 $(C(10))=$(I,10)
1180 FOR J=0 TO 2 STEP =1
1190 IF $(C(J))<$(C(J-1)) THEN 1260
1200 T=$(C(J-1)):T$(NAME$(J-1))
1210 $(C(J-1))=$(C(J)):NAME$(J-1)=NAME$(J)
1220 $(C(J))=T:NAME$(J)=T$(
1230 NEXT J
1240 NEXT I
1250 FOR DL=1 TO 5000:NEXT
1260 CLS:PRINT#10,"HIGH SCORE:"
1270 FOR I=1 TO 10
1280 PRINT NAME$(I) TAB(20) $(C(I))
1290 NEXT I
1300 PRINT:INPUT"ANOTHER GAME (Y/N)?"$(A)
1310 IF $(A)>"N" THEN 600
1320 END
1330 REM MOVE BALL, WAIT FOR FIRE
1340 BX=10:BY=10:BX=0
1350 SOUND 50,1:SOUND 45,1
1360 PUT $(X-10,BY-10)-(BX+10,BY+10),B,PSET
1370 IF PEEK $(X+5000)=126 OR PEEK $(X+5000)=254 OR PEEK $(X+5000)=223 THEN 1430
1380 PUT $(X-10,BY-10)-(BX+10,BY+10),BL,PSET
1390 IF I=0 THEN 1410
1400 A=$(DYSTX(00)+BY-BY-B$(JOYSTX(11)<=31 AND BY(180)+$(JOYSTX(11)<=31 AND BY(121)<=
OTO 1360
1410 IF PEEK $(X+5000)=223 THEN I = 1 ELSE IF PEEK $(X+5000)=223 THEN I = 2
1420 BY=BY-B$(I=2 AND BY(180)+$(I=1) AND BY(121)<=0)OTO 1360
1430 REM MOVE BALL ACROSS TO SKITTLES
1440 PUT $(X-10,BY-10)-(BX+10,BY+10),BL,PSET
1450 FOR I=1 TO 38
1460 BX=BX+4
1470 PUT $(X-10,BY-10)-(BX+10,BY+10),B,PSET
1480 PUT $(X-10,BY-10)-(BX+10,BY+10),BL,PSET
1490 NEXT I
1500 REM CHECK FOR SKITTLES HIT
1510 B=1:B=0
1520 FOR R=1 TO 4
1530 FOR N=1 TO R
1540 $(X=(R-1)*4+N
1550 IF B=0 OR H$$(X)>0 THEN 1600
1560 B=$(X)-7$(X)
1570 IF $(X)>=10 THEN 1600
1580 H$(X)=$(X)+(10+24+43/16)
1590 B=0
1600 ON H$(X)+1 GOTO 1730,1630,1630,1640,1630,1630,1640,1670,1660,1700,1720,1730
1610 H$(X)+1)=0:IF H$(X)+1)=0 THEN H$(X)+1)=0
1620 GOTO 1730
1630 H$(X)+4)=3:GOTO 1730
1640 H$(X)+4)=3:H$(X)+5)=4:GOTO 1730
1650 H$(X)+4)=4:H$(X)+5)=10:GOTO 1730
1660 H$(X)+4)=3:H$(X)+5)=6:GOTO 1730
1670 H$(X)+5)=3:GOTO 1730
1680 H$(X)+5)=3:IF H$(X)-1)=0 THEN H$(X)-1)=9
1690 GOTO 1730
1700 IF H$(X)+1)=0 THEN H$(X)+1)=8
1710 GOTO 1730
1720 IF H$(X)-1)=0 THEN H$(X)-1)=9
1730 IF H(10)=9 AND H(9)=0 THEN H(9)=9 ELSE IF H(10)=9 THEN H(11)=9
1740 IF H(11)=9 THEN H(13)=9
1750 NEXT N
1760 REM COUNT & BALANCE OUT SKITTLES HIT

```

Continued on page 43


```

1750 FOR N=1 TO 8
1760 SW=IR-1:SW=4
1770 IF HIRK>0 THEN SW=1:IF PPOINT(1,SW),YIRK)=2 THEN CIRCLE(X,IRK),Y,SW,1,8,3:
PRINT(1,SW),YIRK),3,3: SOUND250,1: SOUND250,1
1800 NEXT N
1810 REM MOVE BALL ACROSS TO NEXT ROW OF SKITTLES
1820 FOR J=1 TO 3
1830 SW=SW+4
1840 PUT(SW-10,SY-101-IRK+10,SY+10),3,PSET
1850 PUT(SW-10,SY-101-IRK+10,SY+10),3,PSET
1860 NEXT J
1870 NEXT N
1880 RETURN
1890 REM STRIKE
1900 FOR J=0 TO 4
1910 PCL=J:1: SOUND200,1: SOUND190,1: NEXT J
1920 X=2+(J-1)*20:Y=20+(PL-1)*50
1930 A(PL),P=0
1940 PPODE4,3: SCREEN1,1: COLOR0,5
1950 LINE(X,Y-15+20,Y+10),PSET:L,LINE(X+20,Y-15,Y+10),PSET
1960 RETURN
1970 REM SCORE
1980 FOR J=1 TO 4
1990 PCL=J:1: SOUND150,3: NEXT J
2000 A(PL),P=1: PPODE4,3: SCREEN1,1: COLOR0,5
2010 X=4+(J-1)*20:Y=20+(PL-1)*50
2020 DRAW"BP"+STR$(X)+"", "+STR$(Y)+"", "+HB(C(1))+"BC2F10"
2030 RETURN
2040 REM WRITE SCORE
2050 D=INT(15*(PL-K)+0.5)/100
2060 D2=INT(15*(PL-K)-D+0.50+0.1)/10
2070 D3=5*(PL-K)-D3+100-D2+0
2080 X=4+(K-1)*20:Y=20+(PL-1)*50
2090 DRAW"BP"+STR$(X)+"", "+STR$(Y)+"", "+HB(D1)+HB(D2)+HB(D3)
2100 RETURN

```



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Solit

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THE RULES of Solit are roughly the same as those of the famous puzzle Solitaire. You have 32 holes and 32 balls. The holes are arranged in a cross pattern and the balls go in the holes. The central hole is left empty.

A ball is removed if another is made to jump over it and into an empty hole. The object of the puzzle is to remove all of the balls apart from one which must be in the centre hole at the end.

Solit features some useful aids to solving this puzzle:

1. It can record at any time your current position and moves.
2. Using the recorded data you may update it with further moves and then reverse it.
3. Or you may wish to review automatically all your moves up to this place.
4. During the review mode it will return control to the keyboard and manual operation. This means that any recorded Solit data can be updated from any point up to the recorded position. This makes it possible to edit moves.

To move a ball, type in its co-ordinates pressing "Enter" after each one, then use an arrow key to give direction of jump, and press "Enter" again. Each operation can be changed by typing another key before "Enter" or by typing C.

- C — Cancel move.
- M — Manual mode.
- S — Save position.
- R — Restart position.

The computer then asks whether you wish to use any recorded data. If the answer is yes, then you can choose from three automatic modes:

1. Start in manual mode from recorded position.
2. Review all moves up to recorded position automatically.
3. Review all moves up to recorded position. (ENTERING each separate move yourself, with manual control).

Solutions to the puzzle can be obtained for £1.25 (including postage and packaging and cassette) by writing to K. Spinner, 88 Alnham Road, Cleevespex, DN28 8DP.

```
10 CLEAR 1000:GOSUB INH(1000)
20 GOSUB PRINTE:INH(57)==" SSS 000 L L L L L T T T T T":INH(58)==" N S O O L
   1 T":INH(59)==" S O O L 1 T":INH(60)==" S O O L
   1 T":INH(61)==" S O O L 1 T"
30 INH(62)==" S S O O L 1 T":INH(63)==" SSS 000 L L L L T T T T
T*FOR I=57TO 63:PRINT INH(I):NEXT I
40 FOR N=21 TO 1000:GOSUB INH(10)
50 PRINT:PRINT "DO YOU WANT INSTRUCTION (Y/N)"
60 INH=INH(64):IF INH==" THEN GOTO
70 IF INH==" THEN 190
80 PRINT:PRINT "***** INSTRUCTIONS *****"
90 INH(11)==" THE RULES OF SOLIT ARE ROUGHLY":INH(12)==" THE SAME AS THAT OLD FAMOUS
"EMH(13)==" PUZZLE SOLITAIRE. YOU HAVE 32:INH(14)==" BALLS AND 32 HOLES. THE HOLES
"EMH(15)==" ARE ARRANGED IN CROSS PATTERN."
100 INH(16)==" THE BALLS GO IN THE HOLES":INH(17)==" THE CENTRAL HOLE IS LEFT EMPTY"
"EMH(18)==" A BALL IS REMOVED IF ANOTHER:EMH(19)==" IS MADE TO JUMP OVER IT AND":EMH(20)==" INTO AN EMPTY HOLE. THE OBJECT:EMH(21)==" OF THE PUZZLE IS REMOVE ALL OF
"
110 INH(22)==" THE BALLS AWAY FROM ONE WHICH":INH(23)==" MUST BE IN THE CENTER HO
LE AT:INH(24)==" THE END OF THE PUZZLE. ":INH(25)==" *****
"EMH(26)==" SOLIT FEATURES SOME UNUSUAL:EMH(27)==" AIDS TO SOLVING THIS PUZZL
S 1"
120 INH(28)==" 1 IT CAN RECORD AT ANY TIME:EMH(29)==" YOUR CURRENT POSITION & NO
VES":INH(30)==" 2 USING THIS RECORDED DATA ":EMH(31)==" YOU MAY UPDATE IT WITH FU
RMH(32)==" MOVES AND THEN REVERSE IT.":EMH(33)==" 3 OR YOU MAY WISH TO REVE
SH"
130 INH(34)==" ALL YOUR MOVES UP TO THIS PLACE":INH(35)==" ,USE 'ENTER' FOR NEXT M
OVES":INH(36)==" 4 DURING THIS REVIEW MODE 'H':INH(37)==" WILL RETURN CONTROL B
ACK TO:INH(38)==" KEYBOARD AND MANUAL OPERATION."
140 INH(39)==" THIS MEANS THAT ANY RECORDED:EMH(40)==" 'SOLIT' DATA CAN BE UPDATE
S 4:INH(41)==" FROM ANY PLACE UP TO THE REC.":EMH(42)==" POSITION. THIS MAKES IT PO
S":INH(43)==" SIBLE TO EDIT MOVES & PLACES":EMH(44)==" *****
150 INH(45)==" TO HAVE A BALL TYPE IN IT'S:INH(46)==" COORDINATES PRESSING 'ENTER
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TELETYPE


```

710 IF AUC<>"2" THEN L=VAL(LEFT$(L7 OR L8) THEN SOUND 1,5,LE="C":GOTO 630
720 IF AUC="Y2" THEN H=H+1:Y=Y+1:LE="V":GOTO 640 ELSE H=H+1:Y=Y+1:LE="V":GOTO 640
730 PUT(200,140)-(230,400):BL
740 IF LE="C" AND H=0 AND AUC<>"Y2" THEN SOUND 1,5,LE="C":GOTO 630
750 IF LE="C" AND AUC<>"Y2" THEN H=0:GOTO 730
760 SOUND "C#220,1600":IF H=0 THEN DRAW"BRHC20,400":
770 DRAW HL(1):IF AUC<>"Y2" THEN GOTO 630 ELSE H=20
780 SOUND 170,1:IF Y=1 THEN GOTO
790 H=H+EY:GOTO 640
800 LE="E":Y=Y+1:H=10+24*H:Y=Y+6+22*H:2
810 IF POINT(100+H,EY+6)=2 OR POINT(100+H,EY+6)=1 THEN SOUND 1,5,LE="C":GOTO
730
820 PUT(10,171)-(10,12,17,12):BL:GOTO 870
830 PUT(10,171)-(10,12,17,12):BL:IF AUC<>"2" THEN LE="V":
840 IF Q=2 THEN GOTO 840
850 IF Q=2 THEN H=H+1:LE="V":GOTO 840 ELSE LE="C":H=H+1
860 IF LE="C" THEN GOTO 840 ELSE GOTO
870 IF LE="V" THEN FOR T=1 TO 15:NEXT T:RETURN
880 IF ASC(LE)=13 AND Q=1 THEN Q=Q+1:GOTO 170,1:RETURN
890 H=ASC(LE):IF AUC="Y2" AND Y=2 THEN H=H+1:LE="V":GOTO
900 IF H=0 THEN H=1:Q=1 ELSE IF H=9 THEN H=2:Q=1
910 IF H=9 THEN H=2:Q=1
920 IF H=10 THEN H=4:Q=1
930 IF Q=0 THEN RETURN
940 IF Y=0 THEN GOTO
950 PUT(200,141)-(240,160):BL
960 IF LE="C" THEN Q=0:RETURN
970 DRAW"BRHC20,160":AND H=0
980 Y=Y+1:IF AUC<>"Y2" THEN RETURN
990 H=H+EY:IF H=9 AND H=9 THEN RETURN ELSE IF H=9 THEN RETURN
1000 IF H=9 AND H=9 THEN GOTO 840:RETURN
1010 IF ASC(LE)=13 THEN RETURN
1020 SOUND 170,1
1030 Y=Y+1:IF AUC<>"Y2" THEN H=H+1:LE="V":GOTO 840 ELSE H=H+1:LE="V":GOTO 840
H=H+1:Q=1
1040 ON H GOTO 1140,1100,1060,1100
1050 IF POINT(100+H,EY+6)=2 THEN SOUND 1,5,LE="C":GOTO 1050
1060 IF POINT(100+H,EY+6)=1 THEN SOUND 1,5,LE="C":GOTO 1060
1070 PUT(10,171)-(10,12,17,12):BL
1080 PUT(10,171)-(10,12,17,12):BL
1090 PUT(10,171)-(10,12,17,12):BL:PUT(10,171)-(10,12,17,12):BL:GOTO 1220
1100 IF POINT(100+H,EY+6)=2 THEN SOUND 1,5,LE="C":GOTO 1100
1110 IF POINT(100+H,EY+6)=1 THEN SOUND 1,5,LE="C":GOTO 1100
1120 PUT(10,171)-(10,12,17,12):BL
1130 PUT(100+H,EY)-(100+H,EY+12):BL:PUT(100+H,EY)-(100+H,EY+12):BL:GOTO 1220
1140 IF POINT(100+H,EY+6)=2 THEN SOUND 1,5,LE="C":GOTO 1140
1150 IF POINT(100+H,EY+6)=1 THEN SOUND 1,5,LE="C":GOTO 1150
1160 PUT(10,171)-(10,12,17,12):BL
1170 PUT(100+H,EY)-(100+H,EY+12):BL:PUT(100+H,EY)-(100+H,EY+12):BL:GOTO 1220
1180 IF POINT(100+H,EY+6)=2 THEN SOUND 1,5,LE="C":GOTO 1180
1190 IF POINT(100+H,EY+6)=1 THEN SOUND 1,5,LE="C":GOTO 1190
1200 PUT(10,171)-(10,12,17,12):BL
1210 PUT(100+H,EY)-(100+H,EY+12):BL:PUT(100+H,EY)-(100+H,EY+12):BL
1220 H=H+EY:LE="V":GOTO 840
1230 IF H=3 THEN FOR T=1 TO 4:FOR T=1 TO 4:PP=20*(T+1):SOUND 130+10*(T+1):PP=0:GOTO
1240 IF AUC="V" AND H=24 THEN PRINT "WHE A WIZ KID!! YOU SHOULD," THEN THIS
UP FOR A LEVING!!":PRINT:PRINT "DO YOU WANT TO RECORD (Y/N)":GOTO 1270
1250 PUT(10,171)-(10,12,17,12):BL
1260 IF H=3 THEN AUC="V"
1270 GOTO 730
1280 SCREEN 0:CLS:PRINT "ARE YOU SURE ? (Y/N)"
1290 IF H=3 THEN GOTO 1270
1300 IF AUC="Y" THEN SCREEN 1:RETURN ELSE CLS
1310 FOR T=1 TO 4:FOR T=1 TO 4
1320 CHOS T=0
1330 IF POINT(10,171)=1 OR POINT(10,171)=2 THEN CHOS T=1
1340 NEXT T
1350 CLS:PRINT:PRINT "SAYING NOW READY TO COMMENCE.", "ALL ESSENTIAL DATA CONSTR
UCTED":PRINT
1360 PRINT "PRESS BOTH 'REC' AND 'PLAY' ON," CASSETTE. PRESS SPACE TO BEGIN"

```

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CU134

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```

1350 IF #ERR(1345)<0.023 THEN 1355
1360 OPEN "O",S-1,"SOLIT"
1370 FORT=0TO 5:FORG=0TO 4
1380 PRINT S-1,CHG(T),T:HEAT S,T
1390 PRINT S-1,HH:PRINT S-1,HH
1400 FORT=1TO HH:PRINT S-1,HH(S)
1410 NEXT:CLOSE S-1:HH=HH*5
1420 CLS:PRINT:PRINT "TO RETURN TO THE GAME PRESS R"
1430 SS=[KEY]:IF SS="R"THEN 1435
1440 IF SS="R" THEN SCREEN 1,0:RETURN ELSE CLS:END
1450
1455 OPEN "I", S-1, "SOLIT"
1460 FORT=0TO 5:FORG=0TO 4
1470 INPUT:1,CHG(T),HEAT S,T
1480 INPUT:1,HH:INPUT:S-1,HH
1490 FORT=1TO HH:INPUT:S-1,HH(T)
1500 HH=HH/3
1510 NEXT:IF HH="Y" THEN HH=0
1520 CLOSE:1:GOTO 300
1530 FORT=0TO 5:FORG=0TO 5
1540 IF CHG(T)=1 THEN HEAT S,T ELSE RX=(4+24*G+R)*16+22*T:PUT(RX,RX)-(GX+12,RX+
12),5:HEAT S,T
1550 FORT=1TO HH:RX=(4+G)*
1560 PUT(RX,RX)-(GX+12,RX+12),5
1570 NEXT T:RETURN
1580 HH=HH-3:GOTO 730

```

Waves

From A Evans in Warwick

THIS PROGRAM WILL display any combination of sine and cosine waves. The number of cycles can be altered and waves can be mixed with other waves. Program notes

- 5-70 Enters data about waves.
- 80-95 Drives data.
- 100-180 Decides which wave to draw and works out Y co-ordinates according to number of cycles and wave type.
- 170-190 Returns to text when key pressed and asks whether to mix next wave or clear the screen.

```

10 FORT=0
20 GOTO 100
30 GOTO 100
40 GOTO 100
50 GOTO 100
60 GOTO 100
70 GOTO 100
80 GOTO 100
90 GOTO 100
100 PRINT "WAVE"
110 PRINT "WAVE"
120 PRINT "WAVE"
130 PRINT "WAVE"
140 PRINT "WAVE"
150 PRINT "WAVE"
160 PRINT "WAVE"
170 PRINT "WAVE"
180 PRINT "WAVE"
190 PRINT "WAVE"
200 PRINT "WAVE"
210 PRINT "WAVE"
220 PRINT "WAVE"
230 PRINT "WAVE"
240 PRINT "WAVE"
250 PRINT "WAVE"
260 PRINT "WAVE"
270 PRINT "WAVE"
280 PRINT "WAVE"
290 PRINT "WAVE"
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320 PRINT "WAVE"
330 PRINT "WAVE"
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350 PRINT "WAVE"
360 PRINT "WAVE"
370 PRINT "WAVE"
380 PRINT "WAVE"
390 PRINT "WAVE"
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830 PRINT "WAVE"
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860 PRINT "WAVE"
870 PRINT "WAVE"
880 PRINT "WAVE"
890 PRINT "WAVE"
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940 PRINT "WAVE"
950 PRINT "WAVE"
960 PRINT "WAVE"
970 PRINT "WAVE"
980 PRINT "WAVE"
990 PRINT "WAVE"
1000 PRINT "WAVE"

```

Screen print

From A Evans in Warwick

THIS PROGRAM WAS written for a Dragon 32 + Tandy DMP 190 printer, but it can be easily converted for use on other graphic printers. It takes just over 15 minutes to copy any three screen on to paper. This time can be cut if your printer will work with the POKE 65455.B. If it can, then insert a line: POKE 65455.B

As with most printers, the DMP 190 uses a 1x7 pin printing head. It prints its graphic patterns on a 1x7 grid in a binary formation — eg, 1100001 — one dot at the top and two dots at the bottom (represented digit at top). The Chr code for this formation is formed by finding the decimal value of the graphic pattern and adding 128. For example 1100001 = 67 dec and 67 + 128 =

225 dec (Chr code for graphic pattern with one dot at the top and two dots at the bottom).

In this program the computer checks the screen using PPOINT and if the pixel is on any colour except black it will print the appropriate dot — according to a counter (A). Once the computer has checked 256 pixels both A and Y variable used for the next PPOINT check) are incremented and the whole process starts again on the next column down, until Y = 191 and the printed copy is finished. Every seven columns, when top A ends, the printer will line feed and start printing the next seven columns.

The seven codes at lines 350-360 are the codes for one dot in top column, one dot in second from top column, and so on.

- Other Chr codes are as follows:
- 100 — Designate graphic mode.
- 125 — Line feed. Advances paper one line.
- 143 — Repeat the Chr code 125 (space)

Z times (tabulating picture position).

- 180 — Prints a space if the pixel is not in.
- 190 — Prints buffer and carriage return. Next Chr will be printed on the same line.

- 270 — Returns printer to normal printing mode.

Program notes

- 50-60 Introduction, position at printed copy.
- 80 Tabulate picture according to 25 (picture position).
- 80-85 Printer preparation.
- 90 Display first row screen.
- 100 Put printer into graphics mode.
- 120 Empty buffer.
- 130 Set top A.
- 140 Tabulate picture (left/middle/right).
- 150-160 Increment Y; check for end of screen.

130-190 Set loop for X. Check position Y and if it is GOSUB appropriate line and print appropriate data according to A. ELSE print a space. Repeat seven times without line feed, then line feed and start again.

200-260 Graphics. Check for one dot at the top etc.

270 Return to normal mode and RE RUN program.

The program is relatively easy to operate as nothing too technical is required. Once

the program has been typed in, check it through and save it normally in a place where it can easily be accessed.

REW any existing programs, then LOAD in a program which produces a hi-res display (PMODE 2, 3 or 4). RUN the program and break it when the desired display is reached. (The picture is still in the memory even in text mode).

LOAD and RUN the SCREEN PRINT program. When the computer asks you where you want the picture you should reply with L, M or R; any other reply will be

rejected.

After preparing the printer, press any key. The hi-res picture should be displayed and the printer should, every four or five seconds, print one line of the hi-res screen (if there is anything to print). If nothing happens, break the program and check it through again.

When the program has finished printing, the display will return to text and ask you if you want another copy.

The inverse of a picture can be obtained by changing the <> sign on line 190 to =.



```

10 CLS:PRINT"          SCREEN PRINT" :PRINT"
20 PRINT PRINT"THIS PROGRAM WILL COPY A HI-RES SCREEN ONTO PAPER" :PRINT
30 PRINT"WHERE DO YOU WANT THE PICTURE PRINTED ON THE PAPER?
      left      middle      right"
40 PRINT PRINT$204,"L/M/R" : INPUT Y
50 IF Y<"L" THEN G=2:ELSE IF Y<"M" THEN G=1:ELSE IF Y<"R" THEN G=3:ELSE GOTO 40
60 PRINT
70 PRINT$419,"PREPARE PRINTER THEN PRESS ANY KEY"
80 IF INKEY$="" THEN GOTO 80
90 PMODE 4: SCREEN 1: G
100 PRINT$=2: CHR$(10)
110 Y=1
120 PRINT$=2: CHR$(10)
130 FOR X=1 TO 7
140 PRINT$=2: CHR$(20) : CHR$(2) : CHR$(120)
150 Y=Y+1
160 IF Y=100 THEN GOTO 270
170 FOR X=8 TO 255
180 IF PRINT$(X,Y)<0 THEN ON G GOSUB 300,310,320,330,340,350,360 ELSE PRINT$=2: G
      CHR$(120)
190 NEXT X: PRINT$=2: CHR$(20) : NEXT Y: GOTO 120
200 PRINT$=2: CHR$(120) : RETURN: REM 0000001
210 PRINT$=2: CHR$(130) : RETURN: REM 0000010
220 PRINT$=2: CHR$(132) : RETURN: REM 0000100
230 PRINT$=2: CHR$(134) : RETURN: REM 0001000
240 PRINT$=2: CHR$(144) : RETURN: REM 0010000
250 PRINT$=2: CHR$(150) : RETURN: REM 0100000
260 PRINT$=2: CHR$(192) : RETURN: REM 1000000
270 PRINT$=2: CHR$(30) : SCREEN 0: CLS: PRINT$260,"DO YOU WANT ANOTHER COPY?" : INPUT
      Y: IF Y<"Y" THEN GOTO 10 ELSE IF Y<"N" THEN END: ELSE 270

```

André C. Garçonnet in Wales

THE OBJECT OF this game is to safely land your three supply pods on the surface of Mars. There is a strong gravitational pull from the nearby moon of Ender which draws your pod towards the left. At the beginning of your mission you have 75 units of energy, one of which is used with each thrust of your retro-rockets. The rockets are controlled with the "up" and "right" arrow keys.

If you fail to land your pod safely on a yellow landing pad it will explode and the explosion will destroy the pad and all the surrounding landscape within range. If you do manage to safely land your pod you will

be rewarded with musical tones.

Program notes

60-130 Draw pod; check for instructions.

140-200 Draw landscape; put pod in co-ordinates.

210-340 Calculate descent; check for pod movement; check for landing or crash.

350-640 Appropriate subroutines.

650-850 (crash pod, land pod etc.) instructions.

Variables

Z = Horizontal location of pod.
Y = Vertical location of pod.
FUEL = Number of fuel units left.
SHIP = Number of ships left.
SCORE = Number of ships safely landed.
All subroutines are clearly marked with REM statements.

Martian landings

DRAGON 32 OWNERS

Make your Dragon turn into a real computer with the new Double-Density Delta Disk System.

The Delta Disk System Gives You . . .

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- Full range of business utility and games software AVAILABLE NOW!

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- The price you see is the price you pay. NO HIDDEN \$600 upgrade costs.
- Uses under 2K of user - RAM as DELTA is held in EPROM.
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DELTA (SOFTWARE) - contains DELTA disk Operating System, User Manual, demonstration database	\$125.00
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DELTA 2 - as DELTA 1 but with a single-sided 5 1/4 inch (360K) drive	\$100.00
Disk interface cable (supplied with DELTA 1 or 2)	10.00
DELTA 2 Programmer's Reference Manual - integrated with DELTA	104.00
ROMS - ROMS's full name package for DELTA	114.00
MODS - Delta Disk Management System (optional) and DELTA Systems	120.00

NEW

TOOLKIT FOR DRAGON 32

Business applications now possible for the Dragon 32. Performs the following business functions -

- Full screen editing (copying, deleting, moving of lines). Fully linked to the database via ROMS.
- High performance 180K - already achieved in 180K.
- About 1000 lines of graphics output. Available with commands to instantly edit any screen or to automatically delete colour attributes of selected text or data in a single line.
- Full range of 180K database commands with several 180K options.
- Over 500 user definable macros for DELTA 180K - your own commands.

- Screen buffer to store as you plug in the program cartridge.
- Various screen commands allowing changes to be coded for screen, by ROMS or in going from.
- Super ROMS command which can be right screen only, thus saving graphics on ROMS.
- SEARCH and REPLACE commands for faster program modification.
- Comes complete with 180K database and 180K ROMS.

Available in DELTA 180K or DELTA enhanced format ROMS.

NEW

- DRAGON 32 FORTH (on disk) for DELTA. • Executes up to 10 times faster than BASIC • Language extendable by user defined words • Words can even be defined using the FORTH processor for maximum speed • BASIC and DELTA commands still available from FORTH • Source code stored and can be compiled from disk • FORTH can be saved to disk, including any new definitions • Can be in ROMS or on disk • FORTH processor • Model 32, 180K

SCREEN FOR THE DRAGON 32

- Full screen (180K) and screen (180K) commands
- An enlarged 180K screen display which gives a screen display 180K
- Full screen (180K) and screen (180K) commands
- Automatic scrolling and screen image
- Full screen (180K) and screen (180K) commands
- Full screen (180K) and screen (180K) commands
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MODS FOR THE DRAGON 32

- ROMS (180K) - 180K screen (180K) commands
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ROMS FOR THE DRAGON 32

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```

660 GOTO 199
670 REMAINDER OF ROUTINE*****
680 CLS:PRINT
690 PRINT"YOU MANAGED TO LAND, "SCORE" OUT OF YOUR 3 SHIPS"
700 PRINT"YOU HAVE "FUEL" UNITS OF FUEL LEFT"
710 FOR I=1 TO 1000:NEXT I
720 PRINT$448;"":INPUT"ANOTHER GAME (Y/N)".PB
730 IF PB="N"THEN END ELSE ?
740 PLAY"TZS/CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC"
750 IF FUEL<0 THEN ?00 ELSE RETURN
760 SHIP=SH(I-1):IF SHIP=0 THEN ?00
770 FOR Q=1 TO 30
780 CIRCLEX(2+10*X+10),0,4
790 NEXT Q
800 FOR Q=1 TO 30
810 CIRCLEX(2+10*X+10),0,1
820 NEXT Q
830 Z=200:X=10
840 RETURN
850 CLS:PRINT$6;"PARTIAL LANDINGS"
860 PRINT"THE OBJECT OF THE GAME IS TO LAND THREE SUPPLY PODS ONTO THE PARTIAL
LANDSCAPE.THERE ARE THREE LANDING PADS ON THE SURFACE.YOU START THE
GAME WITH 75 UNITS OF FUEL ONE IS USED WITH EACH RETRO THRUST."
870 PRINT"THE THRUSTS ARE CONTROLLED WITH THE 'UP' AND 'RIGHT' ARROW KEYS"
880 PRINT"THE PODS USE NUCLEAR FUEL AND TOO ROUGH A LANDING WILL CAUSE IT TO E
XPLODE.THE DEBRIS FROM THE EXPLOSIONS WILL REMAIN UNTIL A NEW GAME IS STARTED."
890 PRINT$400;"PRESS A KEY TO CONTINUE"
900 IF INKEY#""THEN ?00
910 CLS:PRINT"IF YOUR FUEL LEVELS GET DANGEROUSLY LOW YOU WILL
GIVE A WARNING SIGNAL.THIS MEANS YOU ONLY HAVE A VERY SMALL AMOUNT OF FUEL
LEFT,IF THE FUEL SUPPLY IS OVER-USED IT WILL CAUSE A NUCLEAR
ACTION."
920 PRINT"WHICH WILL DESTROY YOUR POD."
930 PRINT:PRINT:PRINT"PRESS A KEY TO START"
940 IF INKEY#""THEN ?40 ELSE RETURN
950 GOTO 950
960 PROBE 3,1:PCLS
970 DIM P(20,20)
980 CIRCLE(11,13),5,2
990 OPEN"END.G2"FOR W(2,15)F2"
1000 GET(8,0)-(20,20):P:G
1010 P(0,0):RETURN

```

HCF/LCM

Figure 10. Average annual precipitation (mm) for the period 1979–2000.

THIS PROGRAM PRINTS the highest common factor (hcf) and lowest common multiple (lcm) of any two given positive whole numbers using Euclid's algorithm for the calculation.

Patient

60-80	Input the two numbers.
80	Check that they are positive integers.
100-120	Calculate the tot.
120	Print the tot.
140	Calculate and print the t.cnt.
150-170	See if another evaluation is required.

1000

AJ — The two numbers.
AJ.F — Used to calculate the factorial.
AJ.F finally holds the value of the factorial.
AJ — Holds result of factorial.

```

10 REM FINDING THE HIGHEST
20 REM COMMON FACTOR
30 REM AND LOWEST COMMON MULTIPLE
40 REM OF TWO POSITIVE INTEGERS
50 REM
60 CLS:PRINT"ENTER THE TWO NUMBERS"
70 INPUT"SEPARATED BY SPACE:"
80 INPUT I,J
90 IF I<1 OR J<1 OR I=NOT I+1 OR J=NOT J+1 THEN PRINT"POSITIVE INTEGERS PLEASE!"
   GOTO 80
100 GOTO 110-J
110 R=N-INT(R/N):S=N-N*R:GOTO 110
120 IF R=0 THEN L10
130 PRINT"HIGHEST COMMON FACTOR: "TR$(R)
140 PRINT"LOWEST COMMON MULTIPLE IS: "L10/J
150 PRINT"NOTE: NUMBER (Y/N)"
160 AS=CHR$(78):IF AS="Y" THEN L60
170 IF AS="Y" THEN L60 ELSE IF AS="N"
   THEN STOP:ELSE L60

```

Dragon Answers

If you've got a technical question or problem write to Brian Gedge, Dragon Answers, Dragon User, 1213 Little Newport Street, London WC2R 3LD.

Random(?) numbers

A FRIEND at work recently tried — and failed — to win a car at a fairground throwing six dice with six dice at the same time. I thought I would try this particular "game" out on my Dragon 32 using an array containing six random numbers. Each time I ran it (three times), it gave the same result.

Does this mean that the spin-drum generator is not truly spin-drum or am I into the realm of very improbable probability theory?

*S McDevon,
Cardford,
Sussex*

RAND MICROs use a mathematical algorithm to produce random numbers by means of software. This technique uses "seeds" which are taken and processed by the routine and then stored back as new seeds producing a random number in the process. These seeds are stored in locations 275 to 281 on the Dragon. The results are not truly random but give a repeating cycle of so-called random numbers which is so long as to usually appear random. Is a program such as yours where so many random numbers are used, the whole cycle is used up and repeated and so you will get the same result each time.

To get the seeds in a program so that the same random numbers are used each time the program is run, you give the **RND** argument a negative value — eg. **R = RND (-99)**. To achieve a **PSEUDOMIX** feature on the Dragon, the best way is to use **R = RND (-TIMER)**, this uses a random number (the value of **Timer**) to set the random number seeds — you can't get any more random than that without hardware!

Pound problem

I HAVE had a Dragon 32 computer for two months now and I keep finding a small pound sign (£) in the listings of some programs. Could you please tell me the significance of this and how to obtain it on the Dragon 32.

*R Allison,
Crowth*



THERE IS a simple answer to this one. The ASCII code for a back (\) is 35. You get this using Shift and 3 together and it is used mainly in Print and Input statements.

Some printers have a British version of the ASCII character set where the back sign has been replaced by a pound sign. Therefore, whenever you read '£' in a program listing for the Dragon, enter a back symbol and all will work well.

A Dragon In Aussie

COULD YOU please tell me whether my Dragon 32 will be compatible with the Australian electrical currency? I am emigrating to South Australia soon, and would be sad to have to sell my Dragon.

I know Tandy computers are sold in "Aussie" but I haven't yet heard whether the Dragon or its software is available there.

*S Humphreys,
Chester*

THE AUSTRALIAN TV system is the same as ours as far as the picture goes, that is to say the PAL system. Therefore, I can see no problems with using your Dragon "Down Under", except that the Dragon's sound output will not be compatible with their system.

You can easily overcome this by either taking the sound output from the cassette socket or the monitor socket through an amplifier.

As the Dragon becomes more popular abroad, you should find more and more software readily available for it. Whether the Dragon will be sold in Australia is not certain.

Error mysteries

ONE DAY when I was playing about on my Dragon 32 I came across a few **ERRR** when using **EXEC**. I looked it up in the manual as I have never come across it before and found that it wasn't there. Could you please explain what this error is?

*C Lewis,
Plymouth,
Devon*

THERE HAVE been a number of letters regarding unknown error codes which keep appearing, especially when using **EXEC**. These such as **P/P** (**ERRR**) are not true error messages, but are caused by jumping into the Dragon's error handler routine using **EXEC**. The 8088 'H' register holds the error code. If this is higher than 32 then you will get a garbage error — one that doesn't really exist.

There are, however, three error codes which do exist and which are not mentioned in the Basic manual. **ERR** means undefined function — trying to use **PIA** (8) without **PIF** **PIA**(X) — ... first **PIA** stands for Device Number — when the device number (that which follows 'H' in **PIA**, Open file) is not 0, -1 or -2. Finally, the error code mentioned in this letter, **ERR** — with normal Basic this means "no existent error" (ie. an unknown error), with **ASIC** Basic working it means "the non-existent on disk" and the original meaning has been replaced by **117** **ERRR**. You should never usually get an **ERR** error then normal Basic use and if you do the cause should be investigated.

A suitable recorder

I HAVE a Dragon computer and want to buy a cassette player to use with it. Could you please recommend the most suitable?

*P Shagell,
Widewater,
Kent*

THEORETICALLY ANY good quality cassette recorder with sockets for SRS, MC or better still SLS, and REM for remote control will work with the Dragon. Often the cheaper recorders will work more reliably than expensive ones — because the "binner" the output, the better for computers.

In practice, of course, not all recorders which are said to be "computer compatible" will give 100 per cent reliability, as I know to my cost. The most reliable (and expensive!) cassette I found, and the one I usually use is the Tandy CDR-61. This was designed for use with the Tandy Colour Computer — and we all know the similarities between this and the Dragon. Another good point is that you get a spare tape which will work with the Dragon. As I said, this is rather expensive at over £40, but is the most reliable I know of.

Correction

IN THE November issue of Dragon User, I answered a question from Mr Sean O'Neill regarding connection of a Dragon to a caravan power supply. My answer seems to have caused some confusion so I would like to clarify it.

The Dragon requires two power inputs as I stated — 12V and 0V for test inputs if you regard them as +12, -12, +0, -0. The battery's 12V can be used directly by bypassing the regulator. To obtain the 0V supply I suggested a transformer could be used on the 12V supply. This should have read: "a dropping resistor of the correct value and wattage could be used on the 12V supply and an inverter to obtain the -2V."

Perhaps the safest and simplest solution would be to wire the caravan for 230V AC using a 25W inverter off the battery, so that the normal Dragon power supply could still be used.

A full library

To win Dragon Data's complete range of software, 70 titles in all, you must name an imaginary small business computer and solve the puzzle (with Gordon Lee's advice)

CRASHON, WIGGLE. Sinclair Spectrum and Clio are names of home computers that are recognised around the world. Could you think of a name that will become equally as famous?

This month we want you to name an imaginary small business computer to be launched in 1984 and then solve the puzzle below. The winner will receive the entire Dragon software list for the 32 — 35 titles in all.

Hint: Don't forget that many leading computer manufacturers release a series of small business computers under one name, so whatever name you think of must be capable of expansion. For example, if you want to call the computer "Garnex", then the series could be identified as "Garnex 1" and "Garnex 2" and so-on. However, let your imagination run free. Who knows, if you think of a good enough name we might be able to persuade Dragon Data to use it themselves.

But just how good is your ability as a puzzler? How do you go about working out a solution if you find a particularly hard nut to crack? Primarily, you may find that you must adopt many kinds of approach to flesh out a satisfactory solution, a solution which might call for a pot-pourri of skills including a combination of all or any of: cryptograms, crosswords, acrostics, anagrams, probability and logic, apart from just straightforward maths. As an illustration of this sort of thing, and to try out your ability, did you spot anything unusual about this paragraph?

Here are a few hints that you might find useful in solving puzzles of the type found on this page.

1. **Read the question.** An obvious statement, perhaps, but nevertheless it is surprising how this can be overlooked. Make sure that you know what is required. Have you extracted the maximum amount of information from the question? An odd sentence tucked away in the text may not mean much at first reading, but it may hold a vital clue later on. Is there likely to be a link anywhere in the question?

2. **Plan the work in stages.** Work out how you are going to approach the problem. Have a look to see where your computer can best help you, and where the good old-fashioned pencil-and-paper is called for.

3. **Writing the program.** Efficient programming is the key here. Always check the wording of the question to see if there are any strict cuts. For instance, you might find that in testing a series of numbers only the

Prize

THIS MONTH'S PRIZE is the complete library of titles from the official Dragon Data software list produced for the Dragon 32. At 70 titles currently on the market will be sent to the winner by Dragon Data Ltd. Adventure and arcade games, educational programs, languages, sound and graphics programs will be yours to use and enjoy.

Rules

YOUR ENTRY MUST arrive at Dragon User by the last working day in January. The winner and the solution to the puzzle will be printed in the April issue.

November winner

THE WINNER of November's competition and recipient of an MCP-48 Colour Printer/Plotter from Games and Computers is Martin Standford of Hinghamstead, Devon. He correctly stated that the best highest to-perfect was 602.

even numbers need to be considered. A simple line in your program will achieve that and halve the running time. Conversely, it is not efficient to write a couple of dozen lines if in so doing you take longer than the time that would be saved.

4. **Check your results.** Always check that the computer is doing just what you want it

to. Work out a couple of examples by hand if possible and see that the result is as expected. A bug in the program might not cause it to crash but it can give an erroneous result. For example, a wrongly placed set of brackets in an arithmetical expression — or, when working out angles, are the results given in degrees or radians? Also, don't forget that the computer can only work out values to a certain number of significant figures, and this may also induce certain errors. When you have some results, check them against the original information. Does your answer fit the data?

5. **Sleep on it.** If, despite all your efforts, you still reach a dead end, put the puzzle away and come back to it later. Try not to be too flexible as there may be an approach that you have missed. Ask someone else how they would tackle it, it may be that they can suggest a different interpretation that you have overlooked.

Obviously, it's not possible to cover all eventualities, but you should now be better equipped to tackle some of these puzzles. A number of readers wrote to say that they had had difficulty with the September puzzle in Dragon User, so next month we will be taking a detailed look at the solution.

Now try your skill at this puzzle. Professor Otto Hess, the well-known mathematician, has sent out his New Year cards to his many friends and associates.

H	A	P	P	
N	E	W		
Y	E	A	R	

As was his usual practice, he also included a suitable bribe with the cards to amuse, annoy and puzzle his colleagues. This year was no exception, and what Professor Hess asked them to do was to substitute digits for letters in the greeting "HAPPY NEW YEAR" so that each different letter is to stand for a different digit. This was to be done in such a way that the numbers represented by "HAPPY" and "NEW" were to be perfect squares, and the number represented by "YEAR" was to be prime. In order that they could solve the problem the professor also let them know the value of the letter "P", but, unfortunately, I have forgotten what this value was.

What are the numbers?



THE DAN DIAMOND TRILOGY

My name is Diamond, Dan Diamond, and this is my story. A story of beautiful mermaids, bored robots and dank, dark dungeons. A story that started one muggy day in New York, and like the Big Apple, it's rotten to the core.

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Part II. Lost in Space, in which our hero finds himself stranded on a derelict spacecraft, doomed to travel endlessly through space, or find a way out.

Part III. Fishy Business, in which our hero lands on a watery planet, discovers the source of the plea for help and saves the day.

All three programs cost £8.98 each and are available for the DRAGON 32, BBC MODEL B and 48k ORIC-1 microcomputers. (note: Fishy Business for the BBC and ORIC will be available February 1984).

Cheques or postal orders payable to

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SOFTWARE

17 Norfolk Road, Brighton, East Sussex, BN1 3AA.

Look out for Dan Diamond's next Adventure Series "Franklin in Wonderland" Available Spring 1984

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